



DEPARTMENT OF TRANSPORTATION  
HAZARDOUS MATERIALS REGULATIONS BOARD  
WASHINGTON, D.C. 20590

## Title 49—TRANSPORTATION

### Chapter I—Department of Transportation

[Docket No. HM-2; Amdts. 171-1, 172-1, 173-3, 174-1, 175-1, 177-3, 178-1]

#### RADIOACTIVE MATERIALS AND OTHER MISCELLANEOUS AMENDMENTS

On January 20, 1968, the Hazardous Materials Regulations Board published Docket No. HM-2; Notice No. 68-1 (33 F.R. 750), which proposed amendments to the Department's Hazardous Materials Regulations (49 CFR Parts 170-190 and 14 CFR Part 103). These proposals dealt with a major revision to the regulations for the transportation of radioactive materials, along with a number of other general packaging modifications. The public was given 90 days for comment. Numerous comments were filed and have been studied by the Department staff. Several meetings and discussions were held with staff personnel of the U.S. Atomic Energy Commission (AEC), as required by 18 U.S.C. 834(b), and the amendments reflect the results of those discussions. All other comments suggesting changes, additions, or deletions were carefully considered.

One of the most controversial items in the notice of proposed rule making involved the proposed changes in the regulations for the transportation of radioactive materials by air and bus. Restrictions on shipments of radioactive liquids and shipments of packages having significant external radiation levels had been proposed. After consideration of the comments received, and after evaluation of the impact of the proposal on the atomic energy industry, particularly with regard to the use of radiopharmaceuticals, those proposed restrictions have been deleted, and the present provisions for such shipments have been retained. No regulatory restrictions on shipment of large quantities of radioactive materials are considered necessary since each such shipment is covered by a Department special permit. Each situation can then be analyzed on its own merits, and appropriate restrictions can be imposed in the language of the permit.

Numerous comments were received regarding suggested changes to the Department's proposed labeling system for radioactive materials packages. The proposed system was in harmony with the regulations of the International Atomic Energy Agency (IAEA) and the proposed regulations of the United Nations. Certain parties in the United States felt that those international standards are not appropriate in all respects for U.S. usage, and asked that the use of the labels be modified accordingly. However, the Department believes that the interests of international harmony in this area are overriding, and has retained the IAEA-type labels and labeling criteria. The Department will pursue the item further with the IAEA to determine if changes could be made in the international standards which would reflect the total United States interests.

Many of the modifications in these amendments will require parallel changes in the AEC regulations (10 CFR Part 71) to assure harmony between the two complementary sets of regulations. The AEC has indicated that it expects to be able to publish the necessary amendments to its Part 71 prior to the effective date of these amendments.

Many of the new procedures prescribed in these amendments have been previously authorized by Departmental special permits. Special Permit No. 5000 authorized the use of a drum-type birdcage now listed as the Specification 6M package. Special Permit No. 5300 authorized the use of a type of packaging now listed as the Specification 7A package. Special Permit No. 5400 provided for the shipment of enriched uranium under the terms of § 71.6 of the AEC regulations, and the terms of that permit are now included in § 173.396 of these regulations. Special Permit No. 5417 provided for the transportation of radioactively contaminated items, and the terms of that permit are not included in the low specific activity provisions of § 173.392. Accordingly, those special permits are no longer appropriate, and are hereby terminated. Several of the carriers objected to increasing the transport index from the present limit of 40 to a new limit of 50. Although this increase means that more radioactive materials could be carried aboard a vehicle, it does not present a significant increase in hazard. The extra packages may only be carried under additional transport controls for segregation of packages from passengers, transportation workers, and film. The increase is not mandatory, but only allows more packages to be carried. Each carrier is still free to load his vehicles as he sees fit within the overall regulatory limitations. Studies have shown that the previous limit of 40 was greatly overconservative, and that the new limit of 50 would still provide adequate safety in transportation. The new limit will also provide a higher degree of consistency with the international regulations which already provide for a transport index of 50.

A large number of special permits have been issued for the transportation of fissile radioactive materials under Fissile Class II conditions. Because these amendments reflect the international standard of a transport index limit of 50, rather than the 40 radiation unit maximum presently prescribed in the U.S. regulations, a modification of these permits must be made in order that the number of Fissile Class II packages per vehicle remains the same. Therefore, for all special permits issued prior to September 26, 1968, the allowable transport index listed for Fissile Class II packages is increased by a factor of 1.25; i.e., an increase of 25 percent over the present assignments. All holders of such permits will receive individual notification of this change. Future special permits and revisions to existing permits will reflect the new criteria in making transport index assignments.

The notice of proposed rule making did not utilize the Type A-Type B quantity provisions of the IAEA regulations,

but instead referred only to specified quantities of radioactive materials for the various categories of packaging. This was done at the request of a number of interested parties in the atomic energy field. These parties felt that there was a certain stigma attached to these terms as a result of previous unsuccessful rule making efforts by the Interstate Commerce Commission. However, the comments received indicated that the use of those IAEA terms would be not only acceptable but would clarify and simplify the packaging provisions. Accordingly, those terms are defined and used in these amendments.

On February 28, 1969, all existing Bureau of Explosives (Association of American Railroads) permits for radioactive materials packages will expire. Many comments indicated that the regulations were not sufficiently clear as to whether those previously authorized containers could ever be used again. The acceptability of these containers after February 28, 1969, will be a function of their ability to meet the prescribed structural integrity, shielding, and thermal resistance criteria. In each case, the shipper should examine the design and construction details of his container and compare them to the new regulations. If the container does not fit within one of the prescribed categories or usages, he may not use the container after that date without first having secured a Department special permit. The Department's safety evaluation of each of those containers will be based upon the criteria in these amendments. The detailed procedures for petitioning the Department for a special permit are prescribed in Part 170 of these regulations. Part 170 was published in the FEDERAL REGISTER on June 3, 1968 (33 F.R. 68-6562). Copies of Part 170 may be obtained by writing the Secretary, Hazardous Materials Regulations Board, 400 Sixth Street SW., Washington, D.C. 20590; there is no charge.

The present regulations in § 173.393, mention that containers authorized by the Interstate Commerce Commission (now the Department) under special permit may be used for the transportation of radioactive materials. In the light of the recent publication of Part 170, those statements are extraneous, and have been deleted. This does not mean to imply, however, that special permits are no longer available. Any person may petition the Department to use a container which is not prescribed in the regulations, whether for radioactive materials or any of the other hazardous materials covered in the regulations.

A number of comments were received, primarily from carrier interests, objecting to the shifting of responsibility for vehicle monitoring from the consignee to the carrier. They stated that they had neither the trained personnel nor the equipment to perform such services. The Transportation of Explosives Act (18 U.S.C. 831-835), which gives the Department the responsibility for developing and administering regulations for the safe transportation of hazardous materials, limits the Department's jurisdiction to shippers and carriers. The De-



partment cannot impose requirements on consignees since it has no jurisdiction over them. Carriers have historically been responsible for cleaning up spills of other hazardous materials in their vehicles or on their property. Their responsibility with respect to radioactive materials is no different. The amended regulations prescribe performance standards for monitoring and cleanup of spills. The carrier may utilize the services of any qualified person, including the consignee, in performing the required functions. The present regulations often refer to actions to be carried out by the shipper or his authorized agent. Since 18 U.S.C. 831 includes a shipper's authorized agent in the definition of a shipper, the use of both terms in the same regulatory provision is redundant. Where the term shipper appears in the regulations, it is implied that the term includes his authorized agent. Accordingly, several of the sections have been modified to delete the reference to the authorized agent.

The Department acts as the U.S. competent authority as that term is used in the IAEA regulations. In issuing special permits for radioactive materials packages, the Department is often asked to provide the certificate required of competent authorities in the IAEA regulations. The details of these certificates are outlined in Marginal C-6 of those regulations. In order to provide this information, it will be necessary for the petitioner for the special permit to certify in his petition that his packaging, and the contents (particularly with respect to the special form criteria), meet all of the standards prescribed in the IAEA regulations. Although these amendments will bring the U.S. regulations more in harmony with the international standards, there are still some significant differences that will be dealt with in future rule making actions. It is the shipper's responsibility, as prescribed in § 173.393, to make the determination that his package meets all of the requirements of the foreign countries as well as the United States, and the shipper must certify to the Department that he has made that determination. He must present to the Department the basis of his evaluation that those standards have been met. The Department will review the petitioner's data and, if it is satisfied that the petitioner has in fact made a proper determination, it will issue the necessary IAEA certificate as a part of the special permit.

Several comments indicated that there will be difficulty in complying with the placarding requirements unless there was some indication on the shipping papers as to the type of label required for the packages being shipped. The Board agrees that the shipping paper should contain adequate information from which the placarding requirement can be determined and has therefore amended § 173.427 to require that the shipping paper description include the type of label required.

A number of additional editorial changes have been made throughout the regulations to correct such items as ref-

erences to radioactive materials as Class D poisons, correction of paragraph references, and incorrect format.

At the request of a number of interested parties, the order of presentation of the radioactive materials packaging criteria in Part 173 has been modified to clarify the applicability of certain requirements, and to simplify the use of the regulations. This modified order of presentation is also more in harmony with the regulations for transportation of other hazardous materials.

In addition to the general changes discussed above, a number of specific changes to the notice of proposed rule making are worthy of highlighting.

Proposed § 173.22 has been modified to separate the subject of shipper's responsibility from the types of packages authorized under "grandfather clauses." The latter have been included in a new § 173.23. In § 173.23, two additional months have been provided for continued use of packages operating under permits from the Bureau of Explosives. The expiration date of the B of E permits is now February 28, 1969.

A table of steel thicknesses has been added to the general construction standards in § 173.24. The general prohibition against vented packages has been deleted.

In § 173.29, the "Empty" label is now required to be affixed to empty radioactive materials packagings.

In § 173.389, the definition of "fissile materials" has been clarified so that it agrees with the current definition in 10 CFR Part 71 of the USAEC Regulations. The use of the transport index numbers has also been clarified. New definitions for "large quantity" radioactive materials, "Type A" and "Type B" quantities, and "Type A" and "Type B" packaging have been included to obviate the need for repetitive definitions throughout the packaging regulations.

In § 173.390, an additional transport group, Group VII, has been added to conform with the IAEA regulations, and to obviate the need for descriptive limits throughout the packaging regulations. The provisions for determining the transport group of unknown mixtures have been expanded to conform with the IAEA definition.

In § 173.391, a total package limit has been placed on the amount of tritium which may be shipped under the exemption. The permissible contamination limits for the exempt packages has been changed from "detectable" to "significant removable." The requirement for the marking "Radioactive" on exempt devices has been deleted, and the maximum radioactivity content of each such device has been modified to conform with the IAEA regulations. An exemption has been added to provide for packagings in which natural or depleted uranium (such as shipping casks) is incorporated into the packaging.

Proposed § 173.393 has been modified to provide for a security seal, similar to the present special permit requirements, and in accord with the IAEA provisions. Section 173.393(d) has been clarified with regard to the requirements

for internal bracing. Section 173.393 now includes restrictions on the surface temperatures in order to prevent injury to employees and to reduce the fire hazard to other cargo. The temperature restrictions are those commonly provided in special permits. Special permits are required for all shipments involving high internal decay heat, so this addition represents no change from present practice. Pyrophoric liquids are not authorized for air transportation under either the IATA or the IAEA regulations, and that restriction has been noted in § 173.393(f). Section 173.393(g) has been modified to remove the requirement that the inner container be made of metal. Section 173.393(j) has been reworded for clarification as to its applicability. The radiation level restrictions for occupied positions in private vehicles have been removed, since radiation exposures to personnel operating or riding in those vehicles are adequately controlled by existing regulations of the AEC and the Department of Labor.

Proposed §§ 173.394 and 173.395 have been modified to provide for delivery of IAEA Type A packages to their destination in the United States without need for special permit. Type B packages, other than Spec. 55 or 6M, will require Departmental approval in every case at the present time due to a lack of specification containers for Type B quantities.

Proposed § 173.396 has been modified to provide for package limits for the Specs. 6L and 6M metal packages. The limits are presently specified in Part 178.

Proposed § 173.398 has been modified to prescribe the criteria for Type A packages (normal conditions incident to transportation) as well as the previously prescribed criteria for Type B packages (hypothetical accident conditions). The allowable release of radioactive material from packages under the Type B tests, and the test conditions themselves, have been clarified to conform with the present requirements of 10 CFR Part 71 of the AEC or the IAEA regulations.

In proposed § 173.399, the reference to a zero transport index for the white label has been deleted. An additional example of dual labeling requirements is shown for radioactive materials containing nitric acid. Provisions have been included in § 173.402 to require two radioactive materials labels on opposite sides of each package, and to allow the use of foreign labels which conform to the IAEA regulations. Labels for other hazardous materials which are required for air transportation are authorized for surface transportation as well.

The proposed change in the package marking requirements for full-load shipments of all hazardous materials has been retained. These requirements have been in effect for all shipments by water and for Department of Defense shipments for many years.

The provisions of paragraph (b) have been modified to reflect the shipping paper requirements of § 173.427, which itself has been changed to include informational material required on the shipping papers for radioactive materials shipments. These informational modifi-



cations conform to the IAEA regulations. Section 173.430 has been modified to allow for the use of an optional reference to IATA regulations for air shipments.

Proposed § 177.870(g) has been modified to allow transportation of radioactive materials on buses under essentially the same conditions as presently provided for. Storage and loading restrictions have been prescribed in place of the proposed prohibitions for Category II and III packages.

Specification 2R, in § 178.34, has been modified to provide for reduced size of the letters of identification.

A number of cylinder specifications have been corrected to reflect the proper cross-references to Part 173.

Specification 6L, in § 178.103, has been modified to provide for additional types of spacers ("spiders"). The total quantity of required vermiculite has been deleted as extraneous because the required density provides automatically for the total weight control. Marking requirements have been modified to conform with other steel drum requirements. Closure requirements have been modified to require a specified metal thickness and locking ring attachment. Recent accident tests demonstrated the inadequacy of the more common lightweight locking rings. Loading capacity limitations have been relocated to § 173.396.

Section 103.31 of Title 14 has been modified to clarify the identification of certain labels used on mixed cargoes.

Because of the complex nature of these amendments, and the impact that they will have on the transportation of radioactive materials, and to allow a reasonable time for compliance with the changes made herein, the effective date of the amendments is December 31, 1968. However, compliance with these amendments is authorized on and after the date of publication in the FEDERAL REGISTER.

In consideration of the foregoing, the Hazardous Materials Regulations of the Department of Transportation (14 CFR Part 103 and 49 CFR Parts 170-190) are amended effective December 31, 1968, as set forth below.

(Title 18, U.S.C., secs. 831-835; sec. 9, Department of Transportation Act (49 U.S.C. 1657); Title VI and sec. 902(h), Federal Aviation Act of 1958 (49 U.S.C. 1421-1430, 1472(h)))

Issued in Washington, D.C., on September 26, 1968.

W. J. SMITH,  
Commandant,  
United States Coast Guard.

Issued in Washington, D.C., on September 26, 1968.

SAM SCHNEIDER,  
Board Member for the  
Federal Aviation Administration.

Issued in Washington, D.C., on September 26, 1968.

LOWELL K. BRIDWELL,  
Administrator,  
Federal Highway Administration.

Issued in Washington, D.C., on September 26, 1968.

A. SCHEFFER LANG,  
Administrator,  
Federal Railroad Administration.

1. Chapter I of Title 49 is amended as follows:

## PART 171—GENERAL INFORMATION AND REGULATIONS

I. Section 171.8 is amended by adding the following new paragraphs at the end thereof:

### § 171.8 Definitions.

(i) "Packaging" means the assembly of the containers and any other components necessary to assure compliance with the prescribed packaging requirements.

(j) "Package" means the packaging plus its content of explosives or other dangerous articles, as presented for transportation.

(k) "Transport vehicle" means the conveyance used for the transportation of explosives or other dangerous articles and includes any motor vehicle, rail car, or aircraft. Each cargo-carrying body (trailer, van, box car, etc.) is a separate vehicle.

(l) "Department" means the Department of Transportation.

## PART 172—COMMODITY LIST OF EXPLOSIVES AND OTHER DANGEROUS ARTICLES CONTAINING THE SHIPPING NAME OR DESCRIPTION OF ALL ARTICLES SUBJECT TO PARTS 171-179 OF THIS CHAPTER

II. Part 172 is amended as follows:

(A) By amending, § 172.2 to read as follows:

### § 172.2 Articles not described.

(a) An article whose proper shipping name is not shown in the commodity list in § 172.5, and which must be classified as dangerous under the definitions in § 172.53, § 173.88, § 173.100, § 173.115, § 173.150, § 173.151, § 173.240, § 173.300, § 173.326, § 173.343, § 173.381, or § 173.389 of this chapter, must be prepared and offered for shipment in compliance with the regulations for the appropriate hazard classification.

### § 172.4 [Amended]

(B) In paragraph (a) of § 172.4, amend the listing as follows:

1. Cancel: "Pois. D—Radioactive materials, Class D."
2. Add: "R.A.M.—Radioactive materials."

### § 172.5 [Amended]

(C) In paragraph (a) of § 172.5, amend the commodity list as follows:

Article	Classed as—	Exemptions and packing (see sec.)	Label required if not exempt	Maximum quantity in 1 outside container by rail express
<i>Change</i>				
Fissile radioactive materials.....	Radioactive material..	173.393	Radioactive.....	See § 173.396.
Radioactive devices.....	do.....	173.396		
Radioactive materials, low specific activity (LSA).....	do.....	173.391(b)	None.....	See § 173.391.
Thorium nitrate, solid.....	Radioactive material, oxygen material.	173.392	Radioactive.....	See § 173.392(a).
Uranyl nitrate, solid.....	do.....	173.392	Radioactive and yellow....	100 pounds.
		173.396	do.....	Do.
<i>Add</i>				
Radioactive materials, small quantities.....	Radioactive material..	173.391(a)	None.....	See § 173.391.
Radioactive materials, n.o.s.....	do.....	173.393	Radioactive.....	See §§ 173.393, 173.395.
Radioactive materials, special form.....	do.....	173.393	do.....	See §§ 173.393, 173.394.
<i>Cancel</i>				
Magnesium-thorium alloys in formed shapes (not powdered, and which shall contain not more than 4 percent nominal thorium 232).....	Poison D.....	173.392(e)	Radioactive materials, red.	See § 173.393(L).
Radioactive materials, n.o.s.....	do.....	173.392	Radioactive materials, blue or red.	See § 173.393 (f) and (L).
Uranium, normal or depleted, in solid metal form (not borings, chips, or pieces).....	do.....	173.392(f)	Radioactive materials, red.	See § 173.393(L).

## PART 173—SHIPPERS

III. Part 173 is amended as follows:

(A) The table of contents is amended by adding §§ 173.389, 173.390, 173.397 through 173.399; amending §§ 173.2, 173.22, 173.23, 173.24, 173.28, 173.325, 173.391 through 173.396, and 173.402; amending Subpart G to read as follows:

Sec.  
173.2 Classification; dangerous articles.  
173.22 Shipper's responsibility.

Sec.  
173.23 Previously authorized packaging.  
173.24 Standard requirements for all packages.  
173.28 Reuse of containers.

### Subpart G—Poisonous Materials and Radioactive Materials; Definition and Preparation

173.325 Classes of poisonous materials.  
173.389 Radioactive materials; definitions.  
173.390 Transport groups of radionuclides.  
173.391 Small quantities of radioactive materials and radioactive devices.  
173.392 Low specific activity radioactive material.



Sec.	
173.393	General packaging requirements.
173.394	Radioactive material in special form.
173.395	Radioactive material in normal form.
173.396	Fissile radioactive material.
173.397	Contamination control.
173.398	Special tests.
173.399	Labeling of packages of radioactive materials.
173.402	Labeling of explosives or other dangerous articles.

(B) By amending § 173.2 to read as follows:

**§ 173.2 Classification; dangerous articles.**

(a) Dangerous articles other than explosives having more than one hazardous characteristic, as defined in Parts 170-190 of this chapter, must be classified according to the greatest hazard present. However, such articles which are also Class A poisons or radioactive materials must be classified according to both hazardous characteristics, as defined in this part.

(C) By amending § 173.22 in its entirety to read as follows:

**§ 173.22 Shipper's responsibility.**

(a) Where containers are supplied by the shipper, the shipper shall be responsible to determine that shipments of explosives and other dangerous articles made in containers which, unless otherwise provided in this part (see § 173.9 (c)), have been made, assembled with all parts or fittings in their proper place, and marked in compliance with applicable specifications prescribed in Parts 178 and 179 of this chapter or with specifications of the Department in effect at date of manufacture of container. The shipper may accept the manufacturer's certification or specification marking to determine that the containers were manufactured in accordance with applicable specifications. Where containers are supplied by the carrier, the shipper shall determine that the containers in which commodities are to be loaded are proper containers for the transportation of such commodities by examining the manufacturer's identification plate, specification marking, or certification by the carrier.

(D) By amending § 173.23 in its entirety to read as follows:

**§ 173.23 Previously authorized packaging.**

(a) Where the regulations require Spec. 6D or 37M (§ 178.102 or § 178.134 of this chapter) cylindrical steel overpacks, Spec. 5B, 6J, or 37A (single-trip container) (§ 178.82, § 178.100, or § 178.131 of this chapter) metal drums manufactured before March 18, 1964, having inside Spec. 2S, 2SL, 2T, or 2TL (§ 178.21, § 178.27, § 178.35, or § 178.35a of this chapter) polyethylene container, may be continued in use for the commodities and gross weights for which they were previously authorized.

(b) Reusable molded polyethylene containers for use without overpack complying with Spec. 34 (§ 178.19 of this

chapter), manufactured before September 5, 1966, may be continued in use, if they are plainly marked "ICC-34," and are embossed with the maker's name or symbol, rated capacity, and the month and year of manufacture.

(c) Containers manufactured before January 1, 1967, and approved by the Bureau of Explosives before July 12, 1966, (1) may be continued in use for the shipment of fissile and other radioactive materials under the approved conditions until that approval is terminated by the Department or the Bureau of Explosives, but in no case after February 28, 1969, and (2) may not be used for export unless specifically approved by the Department. Petitions for continuing use of such containers may be filed with the Department under § 170.13 of this chapter.

(E) By amending § 173.24 in its entirety to read as follows:

**§ 173.24 Standard requirements for all packages.**

(a) Each package used for shipping explosives or other dangerous articles under this chapter shall be so designed and constructed, and its contents so limited, that under conditions normally incident to transportation—

(1) There will be no significant release of the explosive or other dangerous article to the environment;

(2) The effectiveness of the packaging will not be substantially reduced; and

(3) There will be no mixture of gases or vapors in the package which could, through any credible spontaneous increase of heat or pressure, or through an explosion, significantly reduce the effectiveness of the packaging.

(b) Materials for which detailed specifications for packaging are not set forth in this part must be securely packaged in strong, tight packages meeting the requirements of this section.

(c) Packaging used for the shipment of explosives or other dangerous articles under this chapter shall, unless otherwise specified or exempted therein, meet all of the following design and construction criteria:

(1) Each specification container shall be marked in an unobstructed area with letters and numerals identifying that specification (e.g., ICC-6J, DOT-6L, DOT MC 306, ICC-105A200-F);

(i) The marking is a certification that the packaging complies with all specification requirements.

(ii) The name and address or the symbol of the manufacturer, or the user, who assumes responsibility for compliance with the specification requirements, shall be included. Symbol letters must be registered with the Bureau of Explosives. Duplicate symbols are not authorized.

(iii) The markings shall be stamped, embossed, burned, printed, or otherwise marked on the packaging to provide adequate accessibility, permanency, and contrast so as to be readily apparent and understood.

(iv) Unless otherwise specified, letters and numerals shall be at least 1/2-inch high.

(v) Packaging which does not comply with the applicable specification listed in Parts 178 and 179 of this chapter must not be marked to indicate such compliance.

(2) Steel used shall be low-carbon, commercial quality steel. Stainless, open hearth, electric, basic oxygen, or other similar quality steels are acceptable. Steel sheets of specified gauges shall comply with the following:

Gauge No.	Nominal thickness (inches)	Minimum thickness (inches)
12	0.1046	0.0946
13	0.0897	0.0817
14	0.0747	0.0677
15	0.0673	0.0603
16	0.0598	0.0533
17	0.0538	0.0478
18	0.0478	0.0428
19	0.0418	0.0378
20	0.0359	0.0324
22	0.0299	0.0269
24	0.0239	0.0209
26	0.0179	0.0159
28	0.0149	0.0129
30	0.0120	0.0110

(3) Lumber used shall be well seasoned, commercially dry, and free from decay, loose knots, knots that would interfere with nailing, and other defects that would materially lessen the strength.

(4) Welding and brazing shall be performed in a workmanlike manner using suitable and appropriate techniques, materials, and equipment.

(5) Packaging materials and contents shall be such that there will be no significant chemical or galvanic reaction among any of the materials in the package.

(6) Closures shall be adequate to prevent inadvertent leakage of the contents under normal conditions incident to transportation. Gasketed closures shall be fitted with gaskets of efficient material which will not be deteriorated by the contents of the container.

(7) Nails, staples, and other metallic devices shall not protrude into the interior of the outer packaging in such a manner as to be likely to cause failures.

(8) The nature and thickness of the packaging shall be such that friction during transport does not generate any heating likely to decrease the chemical stability of the contents.

(d) For specification containers, compliance with the applicable specifications in Parts 178 and 179 of this chapter shall be required in all details, except as otherwise provided in this chapter.

(F) By amending the heading, the introductory text of paragraph (a), and paragraph (h) in § 173.28 to read as follows:

**§ 173.28 Reuse of containers.**

(a) Containers used more than once (refilled and reshipped after having been previously emptied) must be in such condition, including closure devices and cushioning materials, that they comply in all respects with the prescribed requirements for those containers. Repairs must be made in an efficient manner in accordance with requirements for materials and construction as prescribed in



Parts 178 and 179 of this chapter for new containers, or as otherwise prescribed. Parts that are weak, broken, or otherwise deteriorated must be replaced.

(h) Except as provided in this section, single-trip containers made under specifications prescribed in Part 178 of this chapter, from which contents have once been removed following use for shipment of any commodity, shall not be again used as shipping containers for explosives or other dangerous articles. Single-trip containers may be reused if retested before each reuse in accordance with methods approved by the Bureau of Explosives for service for specific commodities or classes of commodities. Applications for permission for reuse should be made to the Bureau of Explosives, 2 Pennsylvania Plaza, New York, N.Y. 10001.

(G) By amending § 173.29(e) to read as follows:

**§ 173.29 Empty containers.**

(e) All packagings and accessories which have been used for shipments of radioactive materials, when shipped as empty, must be securely closed, the external surface must be free of significant removable radioactive contamination as provided in § 173.397(a), and the radiation at the external surface of the packaging must not exceed 0.5 millirem per hour. The "Empty" label, described in § 173.413, must be affixed to the packaging.

(H) By amending the title of Subpart G to read as follows:

**Subpart G—Poisonous Materials and Radioactive Materials; Definition and Preparation**

(I) By amending the section heading and the introductory text of paragraph (a); cancel paragraph (a) (4) of § 173.325 as follows:

**§ 173.325 Classes of poisonous materials.**

(a) Poisonous materials for the purpose of Parts 170-190 of this chapter are divided into three classes according to degree of hazard in transportation.

(4) [Canceled]

(J) By amending the introductory text of paragraph (a) of § 173.343 as follows:

**§ 173.343 Less dangerous poisons, class B, liquid or solid, poison label; definition.**

(a) For the purposes of Parts 170-190 of this chapter and except as otherwise provided in this part, class B poisons are those substances, liquid or solid (including pastes and semisolids), other than class A or class C poisons, which are known to be so toxic to man as to afford

a hazard to health during transportation; or which, in the absence of adequate data on human toxicity, are presumed to be toxic to man because they fall within any one of the following categories when tested on laboratory animals:

(K) By adding new §§ 173.389 and 173.390 as follows:

**§ 173.389 Radioactive materials; definitions.**

For the purpose of Parts 170-190 of this chapter:

(a) "Fissile radioactive material" means the following material: Plutonium-238, plutonium-239, plutonium-241, uranium-233, or uranium-235, or any material containing any of the foregoing materials. See § 173.396(a) for exclusions. Fissile radioactive material packages are classified according to the controls needed to provide nuclear criticality safety during transportation as follows:

(1) *Fissile Class I.* Packages which may be transported in unlimited numbers and in any arrangement, and which require no nuclear criticality safety controls during transportation. For purposes of nuclear criticality safety control, a transport index is not assigned to Fissile Class I packages. However, the external radiation levels may require a transport index number.

(2) *Fissile Class II.* Packages which may be transported together in any arrangement but in numbers which do not exceed an aggregate transport index of 50. For purposes of nuclear criticality safety control, individual packages may have a transport index of not less than 0.1 and not more than 10. However, the external radiation levels may require a higher transport index number but not to exceed 10. Such shipments require no nuclear criticality safety control by the shipper during transportation.

(3) *Fissile Class III.* Shipments of packages which do not meet the requirements of Fissile Classes I or II and which are controlled in transportation by special arrangements between the shipper and the carrier.

NOTE 1: Uranium-235 exists only in combination with various percentages of uranium-234 and uranium-238. "Fissile radioactive material" as applied to uranium-235 refers to the amount of uranium-235 actually contained in the total quantity of uranium being transported.

NOTE 2: Radioactive material may consist of mixtures of fissile and non-fissile radionuclides. "Fissile radioactive material" refers to the amount of plutonium-238, plutonium-239, plutonium-241, uranium-233, uranium-235, or any combination thereof actually contained in the mixture. The "radioactivity" of the mixture consists of the total activity of both the fissile and nonfissile radionuclides. All mixtures containing "fissile material" shall be subject to § 173.396.

(b) "Large quantity radioactive materials" means a quantity the aggregate radioactivity of which exceeds that specified as follows:

(1) Groups I or II (see paragraph (h) of this section) radionuclides; 20 curies.

(2) Groups III or IV radionuclides; 200 curies.

(3) Group V radionuclides; 5,000 curies.

(4) Groups VI or VII radionuclides; 50,000 curies.

(5) Special form material; 5,000 curies.

(c) "Low specific activity material" means any of the following:

(1) Uranium or thorium ores and physical or chemical concentrates of those ores;

(2) Unirradiated natural or depleted uranium or unirradiated natural thorium;

(3) Tritium oxide in aqueous solutions provided the concentration does not exceed 5 millicuries per milliliter;

(4) Material in which the activity is essentially uniformly distributed and in which the estimated average concentration per gram of contents does not exceed:

(i) 0.0001 millicuries of Group I (see § 173.389(h)) radionuclides; or

(ii) 0.005 millicuries of Group II radionuclides; or

(iii) 0.3 millicuries of Groups III or IV radionuclides.

NOTE: This includes, but is not limited to, materials of low radioactivity concentration such as residues or solutions from chemical processing; wastes such as building rubble, metal, wood, and fabric scrap, glassware, paper and cardboard; solid or liquid plant waste, sludges, and ashes.

(5) Objects of nonradioactive material externally contaminated with radioactive material, provided that the radioactive material is not readily dispersible and the surface contamination when averaged over an area of 1 square meter, does not exceed 0.0001 millicurie (220,000 disintegrations per minute) per square centimeter of Group I radionuclides or 0.001 millicurie (2,200,000 disintegrations per minute) per square centimeter of other radionuclides.

(d) "Normal form radioactive materials" means those which are not special form radioactive materials. Normal form radioactive materials are grouped into transport groups (see paragraph (h) of this section).

(e) "Radioactive material" means any material or combination of materials, which spontaneously emits ionizing radiation. Materials in which the estimated specific activity is not greater than 0.002 microcuries per gram of material, and in which the radioactivity is essentially uniformly distributed, are not considered to be radioactive materials.

(f) "Removable radioactive contamination" means radioactive contamination which can be readily removed in measurable quantities by wiping the contaminated surface with an absorbent material. The measurable quantities shall be considered as being not significant if they do not exceed the limits specified in § 173.397.



(g) "Special form radioactive materials" means those which, if released from a package, might present some direct radiation hazard but would present little hazard due to radiotoxicity and little possibility of contamination. This may be the result of inherent properties of the material (such as metals or alloys), or acquired characteristics, as through encapsulation. The criteria for determining whether a material meets the definition of special form are prescribed in § 173.398(a).

(h) "Transport group" means any one of seven groups into which normal form radionuclides are classified according to their radiotoxicity and their relative potential hazard in transportation, and as listed in § 173.390.

(i) "Transport index" means the number placed on a package to designate the degree of control to be exercised by the carrier during transportation. The transport index to be assigned to a package of radioactive materials shall be determined by either subparagraph (1) or (2) of this paragraph, whichever is larger. The number expressing the transport index shall be rounded up to the next highest tenth; e.g., 1.01 becomes 1.1.

(1) The highest radiation dose rate, in millirem per hour at three feet from any accessible external surface of the package; or

(2) For Fissile Class II packages only, the transport index number calculated by dividing the number "50" by the number of similar packages which may be transported together (see § 173.396), as determined by the procedures prescribed in the regulations of the U.S. Atomic Energy Commission, Title 10, Code of Federal Regulations, Part 71.

(j) "Type A packaging" means packaging which is designed in accordance with the general packaging requirements of §§ 173.24 and 173.393, and which is adequate to prevent the loss or dispersal of the radioactive contents and to retain the efficiency of its radiation shielding properties if the package is subject to the tests prescribed in § 173.398(b).

(k) "Type B packaging" means packaging which meets the standards for Type A packaging, and, in addition, meets the standards for hypothetical accident conditions of transportation as prescribed in § 173.398(c).

(l) "Type A quantity" and "Type B quantity" radioactive materials means a quantity the aggregate radioactivity of which does not exceed that specified as follows:

Transport group (see § 173.389(h))	Type A quantity (in curies)	Type B quantity (in curies)
I.....	0.001	20
II.....	0.05	20
III.....	3	200
IV.....	20	200
V.....	20	4,000
VI and VII.....	1,000	54,000
Special form.....	20	4,000

Element <sup>1</sup>	Radionuclide <sup>2</sup>	Transport group						
		I	II	III	IV	V	VI	VII
Actinium (89).....	Ac-227.....	X						
	Ac-228.....	X						
Americium (95).....	Am-241.....	X						
	Am-243.....	X						
Antimony (51).....	Sb-122.....				X			
	Sb-124.....			X				
	Sb-125.....			X				
Argon (18).....	Ar-37.....						X	
	Ar-41.....		X					
	Ar-41 (uncompressed) <sup>3</sup> .....					X		
Arsenic (33).....	As-73.....				X			
	As-74.....				X			
	As-76.....				X			
	As-77.....				X			
Astatine (85).....	At-211.....			X				
Barium (56).....	Ba-131.....				X			
	Ba-133.....		X					
	Ba-140.....			X				
Berkelium (97).....	Bk-249.....	X						
Beryllium (4).....	Be-7.....						X	
Bismuth (83).....	Bi-206.....						X	
	Bi-207.....			X				
	Bi-210.....		X					
	Bi-212.....			X				
Bromine (35).....	Br-82.....				X			
Cadmium (48).....	Cd-109.....				X			
	Cd-115m.....			X				
	Cd-115.....				X			
Calcium (20).....	Ca-45.....				X			
	Ca-47.....				X			
Californium (98).....	Cf-249.....	X						
	Cf-250.....	X						
	Cf-252.....	X						
Carbon (6).....	C-14.....				X			
Cerium (58).....	Ce-141.....				X			
	Ce-143.....				X			
	Ce-144.....			X				
Cesium (55).....	Cs-131.....				X			
	Cs-134m.....			X				
	Cs-134.....			X				
	Cs-135.....				X			
	Cs-136.....				X			
	Cs-137.....			X				
Chlorine (17).....	Cl-36.....			X				
	Cl-38.....				X			
Chromium (24).....	Cr-51.....				X			
Cobalt (27).....	Co-58.....			X				
	Co-57.....				X			
	Co-58m.....				X			
	Co-59.....				X			
	Co-60.....			X				
Copper (29).....	Cu-64.....				X			
Curium (96).....	Cm-242.....	X						
	Cm-243.....	X						
	Cm-244.....	X						
	Cm-245.....	X						
	Cm-246.....	X						
Dysprosium (66).....	Dy-154.....			X				
	Dy-165.....				X			
	Dy-166.....				X			
Erbium (68).....	Er-169.....				X			
	Er-171.....				X			
Europium (63).....	Eu-150.....			X				
	Eu-152m.....				X			
	Eu-152.....			X				
	Eu-154.....		X					
	Eu-155.....				X			
Fluorine (9).....	F-18.....				X			
Gadolinium (64).....	Gd-153.....				X			
	Gd-159.....				X			
Gallium (31).....	Ga-67.....			X				
	Ga-72.....				X			
Germanium (32).....	Ge-71.....				X			
Gold (79).....	Au-193.....			X				
	Au-194.....			X				
	Au-195.....			X				
	Au-196.....				X			
	Au-198.....				X			
	Au-199.....				X			
Hafnium (72).....	Hf-181.....				X			
Holmium (67).....	Ho-166.....				X			
Hydrogen (1).....	H-3 (see tritium).....							
Indium (49).....	In-113m.....				X			
	In-114m.....			X				
	In-115m.....				X			
	In-115.....				X			
Iodine (53).....	I-124.....			X				
	I-125.....			X				
	I-126.....			X				
	I-129.....			X				
	I-131.....			X				
	I-132.....				X			
	I-133.....			X				
	I-134.....				X			
	I-135.....				X			
Iridium (77).....	Ir-190.....				X			
	Ir-192.....			X				
	Ir-194.....				X			
Iron (26).....	Fe-55.....				X			
	Fe-59.....				X			
Krypton (36).....	Kr-85m.....			X				
	Kr-85m (uncompressed) <sup>3</sup> .....					X		
	Kr-85.....			X				
	Kr-85 (uncompressed) <sup>3</sup> .....						X	
	Kr-87.....		X					
	Kr-87 (uncompressed) <sup>3</sup> .....					X		

See footnotes at end of table.

# § 173.390 Transport groups of radionuclides.

(a) List of radionuclides:



Element	Radionuclide	Transport group						
		I	II	III	IV	V	VI	VII
Lanthanum (57)	La-140							
Lead (82)	Pb-203				X			
	Pb-210				X			
Lutetium (71)	Pb-212		X					
	Lu-172		X					
Magnesium (12)	Lu-177				X			
Manganese (25)	Mg-28							
	Mn-52				X			
	Mn-54							
Mercury (80)	Mn-56				X			
	Hg-197m				X			
	Hg-197				X			
	Hg-203				X			
Mixed Fission Products	M-F-P				X			
Molybdenum (42)	Mo-99							
Neodymium (60)	Nd-147				X			
	Nd-149				X			
Neptunium (93)	Np-237							
	Np-239		X					
Nickel (28)	Ni-56		X					
	Ni-59			X				
	Ni-63				X			
Niobium (41)	Ni-65				X			
	Nb-83m				X			
	Nb-95				X			
Osmium (76)	Nb-97				X			
	Os-186				X			
	Os-191m				X			
	Os-191				X			
	Os-193				X			
Palladium (46)	Pd-103				X			
	Pd-109				X			
Phosphorus (15)	P-32				X			
Platinum (78)	Pt-191				X			
	Pt-193				X			
	Pt-193m				X			
	Pt-197m				X			
	Pt-197				X			
Plutonium (94)	Pu-238					X		
	Pu-239		X					
	Pu-240		X					
	Pu-241		X					
	Pu-242		X					
	Po-210		X					
	K-42							
	K-43							
Praseodymium (59)	Pr-142			X				
	Pr-143				X			
Promethium (61)	Pm-147				X			
	Pm-149				X			
Protactinium (91)	Pa-230					X		
	Pa-231		X					
	Pa-233		X					
Radium (88)	Ra-223			X				
	Ra-224		X	X				
	Ra-226		X	X				
	Ra-228			X				
Radon (86)	Rn-220				X			
Rhenium (75)	Re-183							
	Re-186				X			
	Re-187				X			
	Re-188				X			
Rhodium (45)	Rh-103m				X			
	Rh-105				X			
Rubidium (37)	Rb-86				X			
	Rb-87				X			
	Rh Natural				X			
Ruthenium (44)	Ru-97				X			
	Ru-103				X			
	Ru-105				X			
	Ru-106				X			
Samarium (62)	Sm-145			X				
	Sm-147			X				
	Sm-151			X				
	Sm-153				X			
Scandium (21)	Sc-46						X	
	Sc-47						X	
Selenium (34)	Se-48						X	
Silicon (14)	Si-31						X	
Silver (47)	Ag-105						X	
	Ag-110m						X	
	Ag-111						X	
Sodium (11)	Na-22						X	
	Na-24						X	
Strontium (38)	Sr-86m						X	
	Sr-86						X	
	Sr-89						X	
	Sr-90		X					
	Sr-91							
	Sr-92							
	Sr-95							
Sulfur (16)	S-35							
Tantalum (73)	Ta-182							
Technetium (43)	Tc-96m			X				
	Tc-96				X			
	Tc-97m				X			
	Tc-97				X			
	Tc-99m				X			
	Tc-99				X			
	Tc-125m				X			
	Tc-127m				X			
	Tc-127				X			
	Tc-129m				X			
	Tc-129				X			
	Tc-131m				X			
	Tc-132				X			
	Tb-160					X		
	Tb-200					X		
	Tl-201					X		
	Tl-202					X		
	Tl-204					X		
	Tl-227					X		
	Tl-228		X					
	Tl-230		X					
	Tl-231		X					
	Tl-232							
	Tl-234		X					
	Th Natural							
	Th-168							
	Tm-170							
	Tm-171							
	Sn-113							
	Sn-117m							
	Sn-121							
	Sn-125							
	Il-3							
	Il-3 (as a gas, as luminous paint, or adsorbed on solid material)							X
Tungsten (74)	W-181							
	W-185							
	W-187							
	U-230							
	U-232		X					
	U-233							
	U-234		X					
	U-235		X					
	U-236							
	U-238							
	U Natural							
	U Enriched							
	U Depleted							
	V-48							
	V-49							
Vanadium (23)	Xe-126							
	Xe-131m							
	Xe-131m (uncompressed)							
	Xe-133							
	Xe-133 (uncompressed)							
	Xe-135							
	Xe-135 (uncompressed)							
	Yb-176							
Ytterbium (70)								

See footnotes at end of table.



Element <sup>1</sup>	Radionuclide <sup>2</sup>	Transport group						
		I	II	III	IV	V	VI	VII
Yttrium (39)	Y-88			X				
	Y-90				X			
	Y-91m			X				
	Y-91			X				
	Y-92				X			
Zinc (30)	Y-93				X			
	Zn-65				X			
	Zn-69m				X			
	Zn-69				X			
Zirconium (40)	Zr-93				X			
	Zr-95			X				
	Zr-97				X			

<sup>1</sup> Atomic number shown in parentheses.

<sup>2</sup> Uncompressed means at a pressure not exceeding 14.7 p.s.i. (absolute).

<sup>3</sup> Atomic weight shown after the radionuclide symbol.

<sup>4</sup> Fissile radioactive material.

(b) Any radionuclide not listed in the above table shall be assigned to one of the groups in accordance with the following table:

Radionuclide	Radioactive half-life		
	0-1,000 days	1,000 days to 10 <sup>4</sup> years	Over 10 <sup>4</sup> years
Atomic number 1-81.	Group III.	Group II...	Group III.
Atomic number 82 and over.	Group I...	Group I....	Do.

NOTE 1: No unlisted radionuclides shall be assigned to Groups IV, V, VI, or VII.

(c) For mixtures of radionuclides the following shall apply:

(1) If the identity and respective activity of each radionuclide are known, the permissible activity of each radionuclide shall be such that the sum, for all groups present, of the ratio between the total activity for each group to the permissible activity for each group will not be greater than unity.

(2) If the groups of the radionuclides are known but the amount in each group cannot be reasonably determined, the mixture shall be assigned to the most restrictive group present.

(3) If the identity of all or some of the radionuclides cannot be reasonably determined, each of those unidentified radionuclides shall be considered as belonging to the most restrictive group which cannot be positively excluded.

(4) Mixtures consisting of a single radioactive decay chain where the radionuclides are in the naturally occurring proportions shall be considered as consisting of a single radionuclide. The group and activity shall be that of the first member present in the chain, except if a radionuclide "x" has a half-life longer than that of that first member and an activity greater than that of any other member including the first at any time during transportation; in that case, the transport group of the nuclide "x" and the activity of the mixture shall be the maximum activity of that nuclide "x" during transportation.

(L) By amending § 173.391 in its entirety to read as follows:

§ 173.391 Small quantities of radioactive materials and radioactive devices.

(a) Radioactive materials in normal form not exceeding 0.01 millicurie of Group I radionuclides; 0.1 millicurie of

Group II radionuclides; 1 millicurie of Groups III, IV, V, or VI radionuclides; 25 curies of Group VII radionuclides; tritium oxide in aqueous solution with a concentration not exceeding 0.5 millicuries per milliliter and with a total activity per package of not more than 3 curies; or 1 millicurie of radioactive material in special form; and not containing more than 15 grams of uranium-235 are exempt from specification packaging, marking, and labeling, and are exempt from the provisions of § 173.393, if the following conditions are met:

(1) The materials are packaged in strong tight packages such that there will be no leakage of radioactive materials under conditions normally incident to transportation.

(2) The package must be such that the radiation dose rate at any point on the external surface of the package does not exceed 0.5 millirem per hour.

(3) There must be no significant removable radioactive surface contamination on the exterior of the package (see § 173.397).

(4) The outside of the inner container must bear the marking "Radioactive."

(b) Manufactured articles such as instruments, clocks, electronic tubes or apparatus, or other similar devices, having radioactive materials (other than liquids) in a nondispersible form as a component part, are exempt from specification packaging, marking, and labeling, and are exempt from the provisions of § 173.393, if the following conditions are met:

NOTE 1: For radioactive gases, the requirement for the radioactive material to be in a nondispersible form does not apply.

(1) Radioactive materials are securely contained within the devices, or are securely packaged in strong, tight packages, so that there will be no leakage of radioactive materials under conditions normally incident to transportation.

(2) The radiation dose rate at four inches from any unpackaged device does not exceed 10 millirem per hour.

(3) The radiation dose rate at any point on the external surface of the outside container does not exceed 0.5 millirem per hour. However, for carload or truckload lots only, the radiation at the external surface of the package or the item may exceed 0.5 millirem per hour, but must not exceed 2 millirem per hour.

(4) There must be no significant removable radioactive surface contamination on the exterior of the package (see § 173.397).

(5) The total radioactivity content of a package containing radioactive devices must not exceed the quantities shown in the following table:

Transport group	Quantity in curies	
	Per device	Per package
I	0.0001	0.001
II	0.001	0.05
III	0.01	3
IV	0.05	3
V or VI	1	1
VII	25	200
Special form	0.05	20

(6) No package may contain more than 15 grams of fissile material.

(c) Manufactured articles, other than reactor fuel elements, in which the sole radioactive material is natural or depleted uranium, are exempt from specification packaging, marking, and labeling and are exempt from the provisions of § 173.393, if the following conditions are met:

(1) The radiation dose rate at any point on the external surface of the outside container does not exceed 0.5 millirem per hour;

(2) There must be no detectable radioactive surface contamination on the exterior of the package (see § 173.397).

(3) The total radioactivity content of each article must not exceed 3 curies.

(4) The outer surface of the uranium is enclosed in an inactive metallic sheet.

NOTE: Such articles may be packagings for the transportation of radioactive materials.

(d) Shipments made under this section for transportation by motor carriers are exempt from Part 177, except § 177.817, of this chapter.

(M) By amending § 173.392 in its entirety to read as follows:

§ 173.392 Low specific activity materials.

(a) Low specific activity materials, when transported in other than transport vehicles assigned for the sole use of the consignor, are exempt from the provisions of § 173.393 (a) through (g) must be packaged in accordance with the requirements of § 173.395, and must be marked and labeled as required in §§ 173.401 and 173.402.

(b) Low specific activity materials which are transported in transport vehicles (except aircraft) assigned for the sole use of that consignor are exempt from specification packaging, marking, and labeling provided the shipments meet the requirements of paragraph (c) or (d) of this section.

(c) Packaged shipments of low specific activity materials transported in transport vehicles (except aircraft) assigned for the sole use of that consignor must comply with the following:

(1) Materials must be packaged in strong, tight packages so that there will be no leakage of radioactive material



under conditions normally incident to transportation.

(2) Packages must not have any significant removable surface contamination (see § 173.397).

(3) External radiation levels must comply with § 173.393(j).

(4) Shipments must be loaded by consignor and unloaded by consignee from the transport vehicle in which originally loaded.

(5) There must be no loose radioactive material in the car or vehicle.

(6) Shipment must be braced so as to prevent leakage or shift of lading under conditions normally incident to transportation.

(7) Except for shipments of uranium or thorium ores, unconcentrated, the transport vehicle must be placarded with the placards prescribed in accordance with § 174.541(b) or § 177.823 of this chapter, as appropriate.

(8) The outside of each outside package must be stencilled or otherwise marked "Radioactive—LSA."

(d) Unpackaged (bulk) shipments of low specific activity materials transported in closed transport vehicles (except aircraft) assigned for the sole use of that consignor must comply with the following:

(1) Authorized materials are limited to the following:

(i) Uranium or thorium ores and physical or chemical concentrates of those ores.

(ii) Uranium metal or natural thorium metal, or alloys of these materials; or

(iii) Materials of low radioactive concentration, if the average estimated radioactivity concentration does not exceed 0.001 millicurie per gram and the contribution from Group I material does not exceed one percent of the total radioactivity.

(iv) Objects of nonradioactive material externally contaminated with radioactive material, if the radioactive material is not readily dispersible and the surface contamination, when averaged over one square meter, does not exceed 0.0001 millicurie per square centimeter of Group I radionuclides or 0.001 millicurie per square centimeter of other radionuclides. Such objects must be suitably wrapped or enclosed.

(2) Bulk liquids must be transported in the following:

(i) Spec. 103C-W (§§ 179.200, 179.201, and 179.202 of this chapter) tank cars. Bottom fittings and valves are not authorized.

(ii) Spec. MC 310, MC 311, MC 312, or MC 331 (§ 178.330, § 178.331, § 178.337, or § 178.343 of this chapter) cargo tanks. Authorized only where the radioactivity concentration does not exceed 10 percent of the specified low specific activity levels (see § 173.389(c)). The requirements of § 173.393(g) do not apply to these cargo tanks. Bottom fittings and valves are not authorized. Trailer-on-flat-car service is not authorized.

(3) External radiation levels must comply with subparagraphs (2), (3), and (4) of § 173.393(j).

(4) Shipments must be loaded by the consignor, and unloaded by the consignee from the transport vehicles in which originally loaded.

(5) Except for shipments of uranium or thorium ores, unconcentrated, the transport vehicle must be placarded with the placards prescribed in accordance with § 174.541(b) or § 177.823 of this chapter, as appropriate.

(6) There must be no leakage of radioactive materials from the vehicle.

(N) By amending § 173.393 in its entirety to read as follows:

**§ 173.393 General packaging requirements.**

(a) Unless otherwise specified, all shipments of radioactive materials must meet all requirements of this section, and must be packaged as prescribed in §§ 173.391 through 173.396.

(b) The outside of each package must incorporate a feature such as a seal, which is not readily breakable and which, while intact, will be evidence that the package has not been illicitly opened.

(c) The smallest outside dimension of any package must be 4 inches or greater.

(d) Radioactive materials must be packaged in packagings which have been designed to maintain shielding efficiency and leak tightness, so that, under conditions normally incident to transportation, there will be no release of radioactive material. If necessary, additional suitable inside packaging must be used. Each package must be capable of meeting the standards in § 173.398(b) (see also § 173.24). Specification containers listed as authorized for radioactive materials shipments may be assumed to meet those standards, provided the packages do not exceed the gross weight limits prescribed for those containers in Part 178 of this chapter.

(1) Internal bracing or cushioning, where used, must be adequate to assure that, under the conditions normally incident to transportation, the distance from the inner container or radioactive material to the outside wall of the package remains within the limits for which the package design was based, and the radiation dose rate external to the package does not exceed the transport index number shown on the label. Inner shield closures must be positively secured to prevent loss of the contents.

(e) The packaging must be so designed, constructed, and loaded that, when transporting large quantities of radioactive material:

(1) The heat generated within the package because of the radioactive materials present will not, at any time during transportation, affect the efficiency of the package under the conditions normally incident to transportation, and

(2) The temperature of the accessible external surfaces of the package will not exceed 122° F. in the shade when fully loaded, assuming still air at ambient temperature. If the package is transported in a transport vehicle consigned for the sole use of the consignor, the maximum accessible external surface temperature shall be 180° F.

(f) Pyrophoric materials, in addition to the packaging prescribed in this subpart, must also meet the packaging requirements of § 173.134 or § 173.154. Pyrophoric radioactive liquids may not be shipped by air.

(g) Liquid radioactive material must be packaged in or within a leak-resistant and corrosion-resistant inner container. In addition—

(1) The packaging must be adequate to prevent loss or dispersal of the radioactive contents from the inner container, if the package were subjected to the 30-foot drop test prescribed in § 173.398(c) (2)(i); or

(2) Enough absorbent material must be provided to absorb at least twice the volume of the radioactive liquid contents. The absorbent material may be located outside the radiation shield only if it can be shown that if the radioactive liquid contents were taken up by the absorbent material the resultant dose rate at the surface of the package would not exceed 1,000 millirem per hour.

(h) There must be no significant removable radioactive surface contamination on the exterior of the package (see § 173.397).

(i) Except for shipments described in paragraph (j) of this section, all radioactive materials must be packaged in suitable packaging (shielded, if necessary) so that at any time during the normal conditions incident to transportation the radiation dose rate does not exceed 200 millirem per hour at any point on the external surface of the package, and the transport index does not exceed 10.

(j) Packages for which the radiation dose rate exceeds the limits specified in paragraph (i) of this section, but does not exceed at any time during transportation any of the limits specified in subparagraphs (1) through (4) of this paragraph, may be transported in a transport vehicle (except aircraft) assigned for the sole use of that consignor, and unloaded by the consignee from the transport vehicle in which originally loaded.

(1) 1,000 millirem per hour at 3 feet from the external surface of the package (closed transport vehicle only);

(2) 200 millirem per hour at any point on the external surface of the car or vehicle (closed transport vehicle only);

(3) 10 millirem per hour at 6 feet from the external surface of the car or vehicle; and

(4) 2 millirem per hour in any normally occupied position in the car or vehicle, except that this provision does not apply to private motor carriers.

(k) When radioactive materials are loaded by the shipper into a transport vehicle assigned for the sole use of that shipper, the shipper must observe all applicable requirements of Part 174, 175, or 177 of this chapter, as appropriate.

(l) Packages consigned for export are also subject to the regulations of the foreign governments involved in the shipment. See §§ 173.8 and 173.9.

(O) By amending § 173.394 in its entirety to read as follows:



**§ 173.394 Radioactive material in special form.**

(a) Type A quantities of special form radioactive materials must be packaged as follows:

(1) Spec. 5B, 5D, 6A, 6B, 6C, 6J, 6K, 6L, 6M, 17C, 17H, 42B, or 42C (§§ 178.82, 178.84, 178.97, 178.98, 178.99, 178.100, 178.101, 178.103, 178.104, 178.107, 178.108, 178.115, and 178.118 of this chapter) metal drums.

(2) Spec. 21C (§ 178.224 of this chapter) fiber drums.

(3) Spec. 14, 15A, 15B, 15C, 15D, 19A, or 19B (§§ 178.168, 178.169, 178.170, 178.171, 178.190, and 178.191 of this chapter) wooden boxes.

(4) Any Spec. 12 series (§§ 173.205 through 178.212 of this chapter) fiberboard boxes, 200-pound test minimum, or Spec. 23F or 23H (§ 178.214 or § 173.219 of this chapter) fiberboard boxes.

(5) Spec. 55 (§ 178.250 of this chapter) metal-encased shielded container. Additionally authorized for not more than 300 curies per package, for domestic shipments only.

(6) Spec. 7A (§ 178.350 of this chapter) Type A general package.

(7) Foreign-made packagings which bear the symbol "Type A" may be used for transportation of radioactive materials from the point of entry in the United States to their destination in the United States or through the United States en route to a point of destination outside of the United States.

(b) Type B quantities of special form radioactive materials must be packaged as follows:

(1) Spec. 55 (§ 178.250 of this chapter) metal-encased shielded container. Authorized only for not more than 300 curies per package. Authorized for domestic shipments only (see also § 173.394 (a) (5) of this chapter).

(2) Spec. 6M (§ 178.304 of this chapter) metal packaging.

(3) Any Type B packaging specifically approved for such use by the Department.

(c) Large quantities of radioactive materials in special form must be packaged as follows:

(1) Spec. 6M (§ 178.104 of this chapter) metal packaging. Radioactive thermal decay energy must not exceed 10 watts.

(2) Any Type B packaging which meets the standards in the regulations of the U.S. Atomic Energy Commission (Title 10, Code of Federal Regulations, Part 71), or the 1967 regulations of the International Atomic Energy Agency, and which has been specifically authorized for such use by the Department under Part 170 of this chapter. In applying for Departmental authorization of packages for large quantities of radioactive materials to be used in shipments by the U.S. Atomic Energy Commission, or one of its contractors or licensees, a copy of the license amendment or other approval issued by that Commission will be accepted in place of the package structural integrity evaluation.

(P) By amending § 173.395 in its entirety to read as follows:

**§ 173.395 Radioactive material in normal form.**

(a) Type A quantities of normal form radioactive materials must be packaged as follows:

(1) Spec. 5B, 5D, 6A, 6B, 6C, 6J, 6K, 6L, 6M, 17C, 17H, 42B, or 42C (§§ 178.82, 178.84, 178.97, 178.98, 178.99, 178.100, 178.101, 178.103, 178.104, 178.107, 178.108, 178.115, and 178.118 of this chapter) metal drums.

(2) Spec. 21C (§ 178.224 of this chapter) fiber drums.

(3) Spec. 14, 15A, 15B, 15C, 15D, 19A, or 19B (§§ 178.165, 178.168, 178.169, 178.170, 178.171, 178.190, and 178.191 of this chapter) wooden boxes.

(4) Any Spec. 12 series (§§ 178.205 through 178.212 of this chapter) fiberboard boxes, 200-pound test minimum; or Spec. 23F or 23H (§ 178.214 or § 178.219 of this chapter) fiberboard boxes.

(5) Any Spec. 3 or 4 series (§§ 178.36 through 178.44 or §§ 178.47 through 178.58 of this chapter) cylinders.

(6) Spec. 55 (§ 178.250 of this chapter) metal-encased shielded container.

(7) Spec. 7A (§ 178.350 of this chapter) Type A general package.

(8) Foreign-made packagings which bear the symbol "Type A" may be used for transportation of radioactive materials from their point of entry in the United States to their destination in the United States or through the United States en route to a point of destination outside of the United States.

(b) Type B quantities of radioactive materials in normal form must be packaged as follows:

(1) Spec. 6M (§ 178.104 of this chapter) metal packaging. Authorized only for solid or gaseous radioactive materials which will not decompose at temperatures up to 250° F.

(2) Any Type B packaging specifically approved for such use by the Department.

(c) Large quantities of radioactive materials in normal form must be packaged as follows:

(1) Spec. 6M (§ 178.104 of this chapter) metal packaging. Authorized only for solid or gaseous radioactive materials which will not decompose at temperatures up to 250° F. Radioactive thermal decay energy must not exceed 10 watts.

(2) Any Type B packaging which meets the standards prescribed in the regulations of the U.S. Atomic Energy Commission (Title 10, Code of Federal Regulations, Part 71) or the 1967 regulations of the International Atomic Energy Agency, and which has been specifically authorized for such use by the Department under Part 170 of this chapter. In applying for Departmental authorization of package for large quantities of radioactive materials to be used in shipments by the U.S. Atomic Energy Commission, or one of its contractors or licensees, a copy of the license amendment or other approval issued by that Commission will be accepted in place of the package structural integrity evaluation.

(Q) By amending § 173.396 in its entirety to read as follows:

**§ 173.396 Fissile radioactive material.**

(a) The following materials are not classified as fissile radioactive materials, are exempted from this section, and must instead be packaged in accordance with the other provisions of this subpart, as appropriate:

(1) Not more than 15 grams of fissile material;

(2) Thorium, or uranium containing not more than 0.72 percent by weight of fissile material;

(3) Uranium compounds other than metal (e.g., UF<sub>4</sub>, UF<sub>6</sub>, or uranium oxide in bulk form, not pelleted or fabricated into shapes), and aqueous solutions of uranium, in which the total amount of uranium-233 and plutonium present does not exceed 1 percent by weight of the uranium-235 content, and the total fissile content does not exceed 1 percent by weight of the total uranium content;

(4) Homogenous hydrogenous solutions or mixtures containing not more than:

(i) 500 grams of any fissile material, provided the atomic ratio of hydrogen to fissile material is greater than 7,600; or

(ii) 800 grams of uranium-235, if the atomic ratio of hydrogen to fissile material is greater than 5,200, and the content of other fissile material is not more than 1 percent by weight of the total uranium-235 content; or

(iii) 500 grams of uranium-233 and uranium-235, if the atomic ratio of hydrogen to fissile material is greater than 5,200, and the content of plutonium is not more than 1 percent by weight of the total uranium-233 and uranium-235 content.

(5) A package containing less than 350 grams of fissile material, if there is not more than 5 grams of fissile material in any cubic foot within the package.

(b) Fissile radioactive materials containing not more than Type A quantities of radionuclides, in either normal form or special form, must be packaged as follows:

(1) Spec. 6L (§ 178.103 of this chapter) metal packaging. Authorized only for not more than 14 kilograms of uranium-235 as metal or oxide, or as compounds or alloys which will not decompose at temperatures up to 750° F. Each package shipped as Fissile Class II shall be assigned a transport index of 1.3 (unless external radiation levels require a higher assignment). The atomic ratio of hydrogen to uranium-235 shall not exceed three, all sources of hydrogen within the inner packaging being considered. The gross weight of the loaded package shall not exceed 350 pounds for the 55-gallon size or 480 pounds for sizes up through 110 gallons.

(2) Spec. 6M (§ 178.104 of this chapter) metal packaging. See paragraph (c) (2) of this section for authorized contents.

(3) Any packaging listed in § 173.395 (a). Authorized only for not more than the following:

(i) 500 grams of uranium-235 as Fissile Class III, or not more than 40 grams



of uranium-235 as Fissile Class II. For Fissile Class II shipments, the transport index to be assigned to each package shall be 0.4 for each gram of uranium-235 above 15 grams up to a maximum of 40 grams (transport index of 10).

(ii) 320 grams of plutonium-239 as plutonium-beryllium neutron sources in special form. Total radioactivity content must not exceed 20 curies. The transport index to be assigned to each package shall be 0.5 for each 20 grams, or fraction thereof, of fissile plutonium.

(4) Any other packaging which meets the standards in the regulations of the U.S. Atomic Energy Commission (Title 10, Code of Federal Regulations, Part 71) the 1967 regulations of the International Atomic Energy Agency, and which has been specifically authorized for such use by the Department under Part 170 of this chapter.

(c) Fissile radioactive materials containing Type B quantities of radio-nuclides, in either normal form or special form, must be packaged as follows:

(1) Spec. 6L (§ 178.103 of this chapter) metal packaging. Authorized only for enriched uranium, the fissile content not to exceed 14 kilograms uranium-235 as metal or oxide, or as compounds or alloys which will not decompose at temperatures up to 750° F. Each package shipped as Fissile Class II shall be assigned a transport index of 1.3 (unless external radiation levels require a higher assignment). The atomic ratio of hydrogen to uranium-235 shall not exceed three, all sources of hydrogen within the inner packaging being considered. The gross weight of the loaded package shall not exceed 350 pounds for the 55-gallon size or 480 pounds for sizes up through 110 gallons.

(2) Spec. 6M (§ 178.104 of this chapter) metal packaging. Authorized only for solid radioactive materials which will not decompose at temperatures up to 250° F. Radioactive thermal decay energy output shall not exceed 10 watts. Large quantity radioactive materials in normal form must be packaged in one or more sealed and leaktight metal cans or polyethylene bottles within the Spec. 2R containment vessel.

(1) *Fissile Class I packages.* The following quantities of fissile radioactive material are authorized for Fissile Class I packages: 1.6 kilograms uranium-235; 0.9 kilograms of plutonium (see Note); 0.5 kilograms of uranium-233. The maximum ratio of hydrogen to fissile material must not exceed three, all sources of hydrogen within the Spec. 2R containment vessel being considered.

Note: Because of the 10-watt thermal decay heat limitation, the limit for plutonium-238 is only 0.02 kilograms.

(ii) *Fissile Class II and III packages.* Quantities of fissile radioactive material as shown in the following table are authorized for Fissile Class II and Fissile Class III packages. Where a maximum ratio of hydrogen to fissile material is specified in the table, only the hydrogen interspersed with the fissile material need

be considered. For Fissile Class II packages, the minimum transport index to be assigned is shown in the table. For Fissile Class III packages, the maximum number

of similar packages per transport vehicle is shown. Fissile Class III shipments are also subject to paragraph (g) of this section.

TABLE OF AUTHORIZED CONTENTS<sup>1</sup>

Uranium-235 <sup>2</sup>			Plutonium <sup>3,4</sup>			Fissile Class II transport index	Fissile Class III, maximum number packages per transport vehicle
Metal or alloy H/X=0	Compounds		Metal or alloy H/X=0	Compounds			
	H/X=0	H/X≤3		H/X=0	H/X≤3		
7.2	7.6	5.2	3.1	4.1	3.4	0.1	1,250
8.7	9.6	6.4	3.4	4.5	4.1	0.2	625
11.2	13.9	8.3	4.2		4.5	0.5	250
13.5	16.0	10.1	4.5			1.0	125
-----	26.0	16.1	-----			5.0	25
-----	32.0	19.5	-----			10.0	12
-----			-----				

<sup>1</sup> Quantity in kilograms.

<sup>2</sup> Maximum uranium-235 enrichment is 93 weight percent.

<sup>3</sup> Minimum percentage of plutonium-240 is 5 weight percent.

<sup>4</sup> 4.5 kilogram limitation on plutonium due to 10 watt decay heat limitation.

(3) Any other packaging which meets the standards prescribed in the regulations of the U.S. Atomic Energy Commission (Title 10, Code of Federal Regulations, Part 71) or the 1967 regulations of the International Atomic Energy Agency, and which has been specifically authorized for such use by the Department under Part 170 of this chapter.

(d) Petitions for authorization of non-specification packagings for fissile radioactive materials must be submitted as prescribed in Part 170 of this chapter, and must also include the following:

(1) Type and amount of fissile radioactive materials which are to be carried in each package, including:

(i) The transport index to be assigned to the package for the proposed package loadings when shipped as Fissile Class II; and

(ii) The maximum number of packages proposed when shipped as Fissile Class III.

(2) A nuclear criticality safety evaluation demonstrating that the packaging design and limitation on its contents are adequate to assure nuclear criticality safety. Any tests performed in this respect should be described.

Note: In applying for Departmental authorization of packages for fissile radioactive materials to be used in shipments by the U.S. Atomic Energy Commission, or one of its contractors or licensees, a copy of the license amendment or other approval issued by that Commission will be accepted in place of the nuclear criticality safety evaluation and the package structural integrity evaluation.

(e) Mixing of packages of other types of radioactive materials, including Fissile Class I, with Fissile Class II packages is permitted if the total transport index in any one transport vehicle or storage location does not exceed 50.

(f) For Fissile Class II packages shipped under the exclusive use provisions of § 173.393(j) to provide for packages with high radiation dose rates, the transport index number which is calculated for nuclear criticality control purposes must not exceed 10 for any single package or a total of 50 for the full load, unless specifically authorized by the Department for Fissile Class III shipments.

(g) Fissile Class III shipments may be made only in accordance with subparagraph (1) or (2) of this paragraph, or in accordance with other procedures authorized by the Department. The transport controls must provide nuclear criticality safety and shall be carried out by the shipper or carrier, as appropriate, to protect against loading, transporting, or storing of that shipment together with other fissile material.

(1) Transportation in a transport vehicle assigned for the sole use of that consignor, with a specific restriction for such sole use to be provided in the special arrangements, and with instructions to that effect issued with the shipping papers; or

(2) Transportation under escort by a person in a separate vehicle, with the escort having the capability, equipment, authority, and instructions to provide administrative controls adequate to assure compliance with this paragraph.

(R) By adding new §§ 173.397, 173.398, and 173.399 to read as follows:

#### § 173.397 Contamination control.

(a) Removable radioactive contamination is not significant if the average amount of radioactive contamination which can be removed by wiping the external surface of the package with an absorbent material, as measured on the wiping material, does not exceed—

(1) 10<sup>-11</sup> curie per square centimeter beta-gamma (2,200 disintegrations/min. per 100 square centimeters) and 10<sup>-12</sup> curie per square centimeter alpha (220 disintegrations/min. per 100 square centimeters) for all contaminants except natural or depleted uranium and natural thorium; or

(2) 10<sup>-10</sup> curie per square centimeter beta-gamma (22,000 disintegrations/min. per 100 square centimeters) and 10<sup>-11</sup> curie per square centimeter alpha (2,200 disintegrations/min. per 100 square centimeters) where the only contaminant is known to be natural or depleted uranium or natural thorium.

(b) Each transport vehicle used for transporting low specific activity radioactive materials in carload or truckload



lots under § 173.392(d) must be surveyed with appropriate radiation detection instruments after each use. Vehicles must not again be placed in service until the radiation dose rate at any accessible surface is not more than 0.5 millirem per hour, and there is no significant removable radioactive surface contamination (see § 173.399).

(1) This paragraph does not apply to any closed transport vehicle (except aircraft) used solely for the transportation of radioactive materials, if a survey of its interior surface shows that the radiation dose rate does not exceed 10 millirem per hour at the interior surface or 2 millirem per hour at 3 feet from any interior surface. These vehicles must be stenciled with the words "For Radioactive Materials Use Only" in lettering at least 3 inches high in a conspicuous place or places, on both sides of the exterior of the vehicle. These vehicles must be kept closed at all times other than loading and unloading.

#### § 173.398 Special tests.

(a) Special form material: To qualify as special form material, the radioactive material must either be in massive solid form or encapsulated. Each item in massive solid form or each capsule must, either have no overall dimension less than 0.5 millimeters, or must have at least one dimension greater than 5 millimeters. Each item, or the capsule material, must not dissolve or convert into dispersible form to the extent of more than 0.005 percent, by weight, by immersion for 1 week in water at pH 6-8 and 68° F., and a maximum conductivity of 10 micro-mhos/centimeter, and by immersion in air at 86° F. If in massive solid form, the radioactive material must not break, crumble, or shatter if subjected to the percussion test prescribed in this section, and must not melt, sublime, or ignite at temperatures below 1,000° F. If encapsulated, the capsule must retain its contents when subjected to all of the performance tests prescribed in this section, and must not melt, sublime, or ignite at temperatures below 1,475° F.

(1) *Free drop.* A free drop through a distance of 30 feet onto a flat essentially unyielding horizontal surface, striking the surface in such a position as to suffer maximum damage.

(2) *Percussion.* Impact of the flat circular end of a one inch diameter steel rod weighing three pounds, dropped through a distance of 40 inches. The capsule or material shall be placed on a sheet of lead, of hardness number 3.5 to 4.5 on the Vickers scale, and not more than one inch thick, supported by a smooth, essentially unyielding surface.

(3) *Heating.* Heating in air to a temperature of 1,475° F. and remaining at that temperature for a period of 10 minutes.

(4) *Immersion.* Immersion for 24 hours in water at room temperature. The water shall be at pH6-pH8, with a maximum conductivity of 10 micro-mhos/cm.

(b) Standards for Type A packaging:

(1) Type A packaging must be so designed and constructed that, if it were

subject to the environmental and test conditions prescribed in this section:

(i) There would be no release of radioactive material from the package;

(ii) The effectiveness of the packaging would not be substantially reduced; and

(iii) There would be no mixture of gases or vapors in the package which could, through any credible increase of pressure or an explosion, significantly reduce the effectiveness of the package.

(2) Environmental conditions:

(i) *Heat.* Direct sunlight at an ambient temperature of 130° F. in still air.

(ii) *Cold.* An ambient temperature of -40° F. in still air and shade.

(iii) *Reduced pressure.* Ambient atmospheric pressure of 0.5 atmosphere (absolute) (7.3 p.s.i.a.).

(iv) *Vibration.* Vibration normally incident to transportation.

(3) Test conditions: The packaging shall be subject to all of the following tests unless specifically exempted therefrom, and also to the consecutive application of at least two of the following tests from which it is not specifically exempted:

(i) *Water spray.* A water spray heavy enough to keep the entire exposed surface of the package except the bottom continuously wet during a period of 30 minutes. Packages for which the outer layer consists entirely of metal, wood, ceramic, or plastic, or combinations thereof, are exempt from the water spray test.

(ii) *Free drop.* Between 1½ to 2½ hours after the conclusion of the water spray test, a free drop through a distance of 4 feet onto a flat essentially unyielding horizontal surface, striking the surface in a position for which maximum damage is expected.

(iii) *Corner drop.* A free drop onto each corner of the package in succession, or in the case of a cylindrical package onto each quarter of each rim, from a height of 1 foot onto a flat essentially unyielding horizontal surface. This test applies only to packages which are constructed primarily of wood or fiberboard, and do not exceed 110 pounds gross weight, and to all Fissile Class II packagings.

(iv) *Penetration.* Impact of the hemispherical end of a vertical steel cylinder 1¼ inches in diameter and weighing 13 pounds, dropped from a height of 40 inches onto the exposed surface of the package which is expected to be most vulnerable to puncture. The long axis of the cylinder shall be perpendicular to the package surface.

(v) *Compression.* For packages not more than 10,000 pounds in weight, a compressive load equal to either five times the weight of the package or 2 pounds per square inch multiplied by the maximum horizontal cross section of the package, whichever is greater. The load shall be applied during a period of 24 hours, uniformly against the top and bottom of the package in the position in which the package would normally be transported.

(c) Standards for hypothetical accident conditions of transportation for Type B packagings:

(1) Type B packaging must meet the applicable Type A packaging standards and must be designed and constructed and its contents so limited that, if subjected to the hypothetical accident conditions prescribed in this paragraph, it will meet the following conditions:

(i) The reduction of shielding would not be enough to increase the radiation dose rate at three feet from the external surface of the package to more than 1,000 millirem per hour.

(ii) No radioactive material would be released from packages containing Type B quantities of radioactive material. The allowable release of radioactivity from packages containing large quantities of radioactive material is limited to gases and contaminated coolant containing total radioactivity exceeding neither 0.1 percent of the total radioactivity of the package contents nor 0.01 curie of Group I radionuclides, 0.5 curie of Group II radionuclides, and 10 curies of Groups III and IV radionuclides, except that for inert gases the limit is 1,000 curies.

(2) Test conditions: The conditions which the package must be capable of withstanding must be applied sequentially, to determine their cumulative effect on a package, in the following order:

(i) *Free drop.* A free drop through a distance of 30 feet onto a flat essentially unyielding horizontal target surface, striking the surface in a position for which maximum damage is expected.

(ii) *Puncture.* A free drop through a distance of 40 inches striking, in a position for which maximum damage is expected, the top end of a vertical cylindrical mild steel bar mounted on an essentially unyielding horizontal surface, the bar shall be 6 inches in diameter, with the top horizontal and its edge rounded to a radius of not more than one-fourth inch, and of such a length as to cause maximum damage to the package, but not less than 8 inches long. The long axis of the bar shall be perpendicular to the unyielding horizontal surface.

(iii) *Thermal.* Exposure to a thermal test in which the heat input to the package is no less than that which would result from exposure of the whole package to a radiation environment of 1,475° F. for 30 minutes with an emissivity coefficient of 0.9, assuming the surfaces of the package have an absorption coefficient of 0.8. The package shall not be cooled artificially until 3 hours after the test period unless it can be shown that the temperature on the inside of the package has begun to fall in less than 3 hours.

(iv) *Water immersion (fissile radioactive materials packages only).* Immersion in water to the extent that all portions of the package to be tested are under at least 3 feet of water for a period of not less than 8 hours.

(d) It is not necessary to actually conduct the tests prescribed in this section if it can be clearly shown, through engineering evaluations or comparative data, that the material or item would be capable of performing satisfactorily under the prescribed test conditions.



**§ 173.399 Labeling of packages of radioactive materials.**

(a) Each package of radioactive materials, unless exempted by § 173.391 or § 173.392, shall be labeled as provided in this section (see § 173.414 for description of labels). The label to be used shall be determined by the transport index or other considerations as follows:

(1) *Radioactive white-I label.* (i) Each package not exceeding 0.5 millirem per hour at any point on the external surface of the package, and which does not come within the provisions of subparagraph (2) or (3) of this paragraph. Not authorized for Fissile Class II packages.

(2) *Radioactive yellow-II label.* When the limit in subparagraph (1) of this paragraph is exceeded but the provisions of subparagraph (3) of this paragraph are not met; and—

(i) Each package not exceeding 10 millirem per hour at any point on the external surface of the package and not exceeding 0.5 millirem per hour at 3 feet from the external surface of the package; or

(ii) Each package for which the transport index does not exceed 0.5 at any time during transportation.

(3) *Radioactive yellow-III label.* When either of the limits in subparagraph (2) of this paragraph is exceeded. In addition, the following types of packages must also bear this label:

(i) Each Fissile Class III package;

(ii) Each package containing a large quantity of radioactive material as defined in § 173.389; or

(iii) Each package being transported under a permit issued as authorized in § 173.23(c).

(b) Radioactive materials having other hazardous characteristics, as defined elsewhere in this part must also be labeled with other labels as required by this part according to the hazards of the commodity (see §§ 173.2 and 173.402). For example:

(1) Packages containing the solid nitrates of uranium or thorium must bear both a "radioactive" label and a "yellow" oxidizing materials label.

(2) Packages containing nitric acid solutions of radioactive materials must bear both a "radioactive" label and a "white" corrosive acid label.

(S) By amending the heading and paragraphs (a) (1) through (8), (11), and (14), (b), introductory text of (c), and (c) (1); by adding paragraphs (a) (15) and (c) (2); canceling paragraphs (a) (9) and (10), (b) (1), and (d) in § 173.402 to read as follows:

**§ 173.402 Labeling of explosives or other dangerous articles.**

(a) Each package containing explosives or other dangerous articles as defined in this part must be conspicuously labeled by the shipper as follows, except as otherwise provided:

(1) "Red" label as described in § 173.405 (a) or (b) on packages of

flammable liquids, except when exempted from labeling requirements in Subpart C of this part.

(2) "Yellow" label as described in § 173.406 (a) or (b) on packages of flammable solids or oxidizing materials, except when exempted from the labeling requirements in Subpart D of this part.

(3) "White" label as described in § 173.407 (a) or (b) on packages of acids, alkaline caustic liquids, or other corrosive liquids, except when exempted from the labeling requirements in Subpart E of this part.

(4) "Red gas" label as described in § 173.408 (a) (1) or (b) on packages of flammable compressed gases, except when exempted from the labeling requirements in Subpart F of this part.

(5) "Green" label as described in § 173.408 (a) (2) or (b) (1) on packages of nonflammable compressed gases, except when exempted from the labeling requirements in Subpart F of this part.

(6) "Poison gas" label as described in § 173.409 (a) (1) on packages of class A poisons.

(7) "Poison" label as described in § 173.409 (a) (2) or (b) on packages of class B poisons, except when exempted from the labeling requirements in Subpart G of this part.

(8) "Radioactive" (white-I, yellow-II or yellow-III) label as described in § 173.414 on packages of radioactive materials, except when exempted from the labeling requirements in Subpart G of this part. Each package must be labeled with two such labels, affixed to opposite sides of the package. The method of determination of which label to use is given in § 173.399.

(i) Labels which conform to the model prescribed in the regulations of the International Atomic Energy Agency, and which are similar in appearance to the labels prescribed herein (although the inscriptions on the labels may be in a foreign language) are authorized in place of the labels prescribed herein for import or export shipments only.

(9) [Canceled]

(10) [Canceled]

(11) "Tear gas" label as described in § 173.409 (a) (3) or (b) on packages of class C poisons.

(14) Labels authorized for shipment of explosives or other dangerous articles by air, as shown in §§ 173.405 through 173.412 may be used in place of the labels otherwise prescribed therein.

(15) Packages containing materials which are either class A poisons or radioactive materials, and are also flammable (gases, liquids or solids), corrosive liquids, class B poisons, oxidizing materials, or compressed gases, must also bear additional labels showing those other hazardous characteristics (see also § 173.2).

(b) Labels required for shipments of explosives or other dangerous articles by air are shown in §§ 173.405(b), 173.406(b), 173.407(b), 173.408(b), 173.409(b),

173.410(b), 173.411(b), 173.412(b), and 173.414.

(1) [Canceled]

(c) Labels are not required on carload or truckload lots of dangerous articles, except for the commodities listed in this paragraph, when the shipments are loaded by the shipper, and are unloaded by the consignee from the transport vehicle in which originally loaded. The commodities for which this exemption does not apply include: classes A or C poisons, etiological agents, and radioactive materials.

(1) Labels are not required on carload or truckload lots of shipments of classes A or C poisons, etiological agents, or radioactive materials made by, for, or to the Department of Defense if the shipments are loaded by the shipper and unloaded by the consignee from the transport vehicle in which originally loaded and if the shipments are accompanied by qualified personnel supplied with equipment to repair leaks or other container failures which would permit escape of contents.

(2) The proper shipping name of the contents (see § 172.5 of this chapter) must be marked on each package shipped under the exemption in this paragraph.

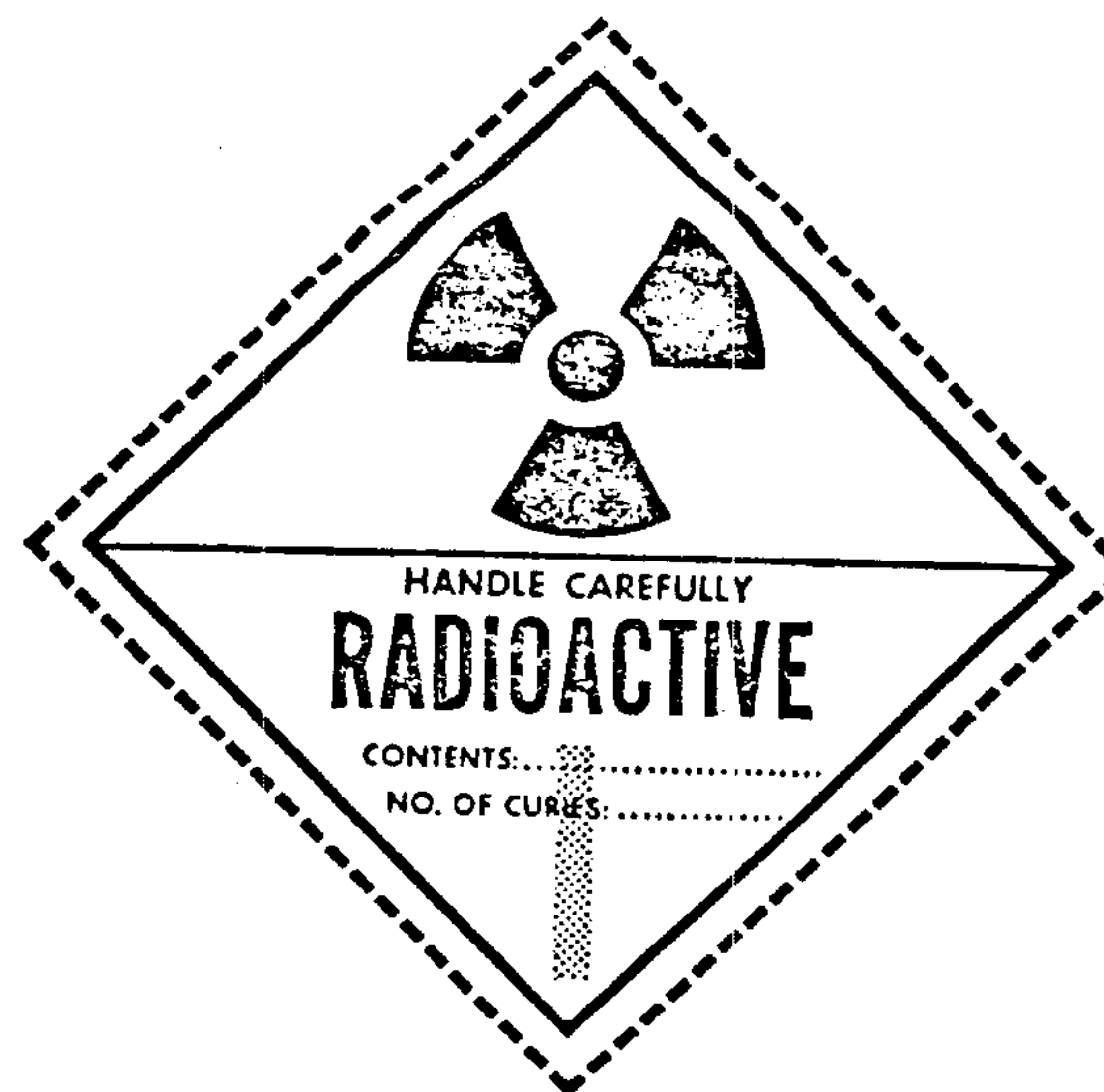
(d) [Canceled]

(T) By amending § 173.414 to read as follows:

**§ 173.414 Radioactive materials labels.**

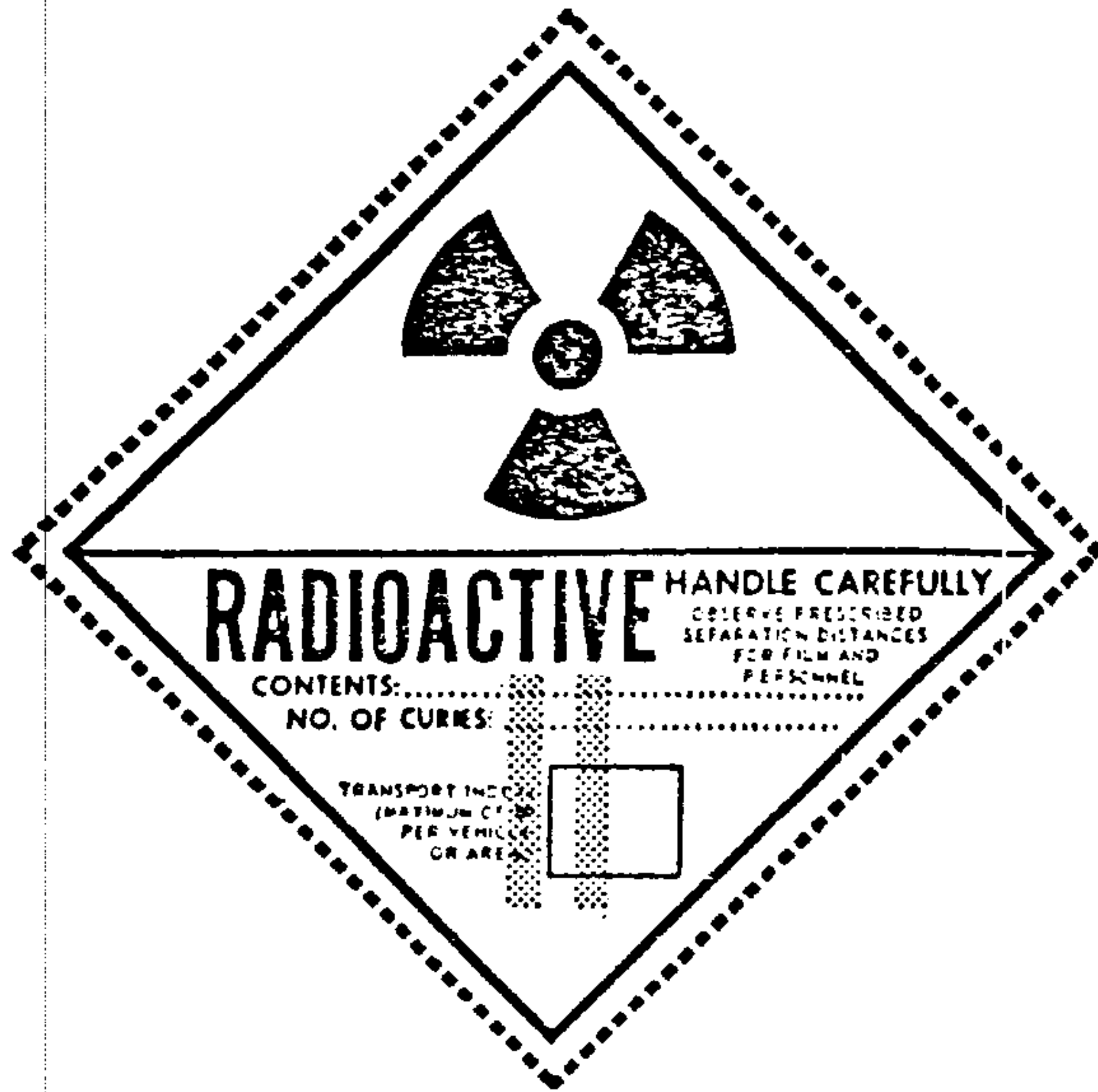
(a) Labels for packages of radioactive materials must be of diamond shape, in colors specified in this section, with each side at least 4 inches long. Printing must be in black inside of a black line border measuring at least 3½ inches on each side and as shown in this section.

(b) "Radioactive white-I" label for radioactive materials. Label must be white in color. The single vertical bar on the lower half of the label must be bright red in color.

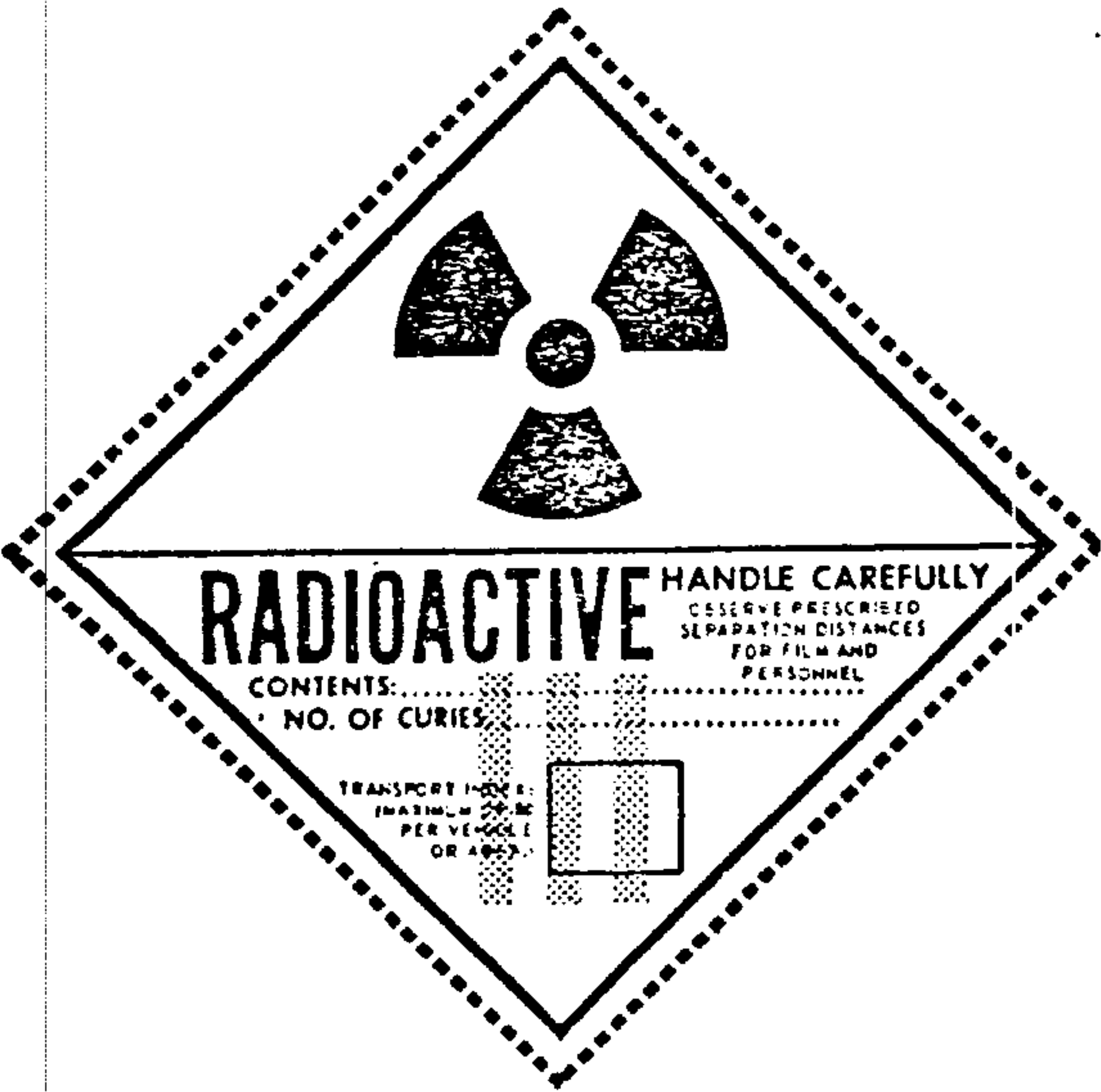


(c) "Radioactive yellow-II" label for radioactive materials. The upper half of the label must be bright yellow and the bottom half must be white. The two vertical bars on the lower half of the label must be bright red in color.





(d) "Radioactive yellow-III" label for radioactive materials. The upper half of the label must be bright yellow and the bottom half must be white. The three vertical bars on the lower half of the label must be bright red in color.



(U) By amending paragraph (a) (2) and adding paragraph (a) (5) in § 173.427 to read as follows:

**§ 173.427 Shipping papers.**

(a) \* \* \*

(2) Where the regulations (except § 173.402) exempt the packages from labeling the exemption must be indicated by the words "No Label Required" immediately following the description on the shipping paper.

(5) For shipments of radioactive materials, the shipping paper description must include:

(i) The Transport Group or Groups of the radionuclides in the radioactive material, if the material is in normal form;

(ii) The name of the radionuclides in the radioactive material, and a description of its physical and chemical form if the material is in normal form;

(iii) The activity of the radioactive material in curies;

(iv) The type of label applied to the package; i.e., Radioactive White-I, Radioactive Yellow-II, or Radioactive Yellow-III;

(v) For fissile radioactive materials, the fissile class of the package, and the weight in grams or kilograms of the fissile isotope; and

(vi) For export shipments, a copy of any special permit issued by the Department for the package.

(V) By amending paragraph (b) of § 173.430 to read as follows:

**§ 173.430 Certificate.**

(b) Shipping papers for air shipments in foreign commerce must be made out in duplicate and the shipper's certificate must be executed on both copies.

(1) For shipments on passenger-carrying aircraft, the shipper must also add the words:

This shipment is within the limitations prescribed for passenger-carrying aircraft.

(2) The shipper may also add the words: " \* \* \* and to the IATA Restricted Articles Regulations."

**PART 174—CARRIERS BY RAIL  
FREIGHT**

IV. Part 174 is amended as follows:

(A) By amending paragraph (b) of § 174.510 to read as follows:

**§ 174.510 Shipping papers.**

(b) Where the regulations (except § 173.402(c) of this chapter) exempt the packages from labeling, the exemption must be indicated by the words "No Label Required" immediately following the description on the shipping paper.

(B) By amending paragraph (j) (1) and (2) of § 174.532 to read as follows:

**§ 174.532 Loading other dangerous articles.**

(1) Shipments of low specific activity materials, as defined in § 173.389(c) of this chapter, must be loaded so as to avoid spillage and scattering of loose material. Loading restrictions are prescribed in § 173.392 of this chapter.

(2) Storage and loading restrictions are prescribed in § 174.586(h).

**§ 174.538 [Amended]**

(C) By deleting the phrase "Class D poisons" from item 15 in vertical and horizontal columns in § 174.538(a) Chart. Item 15 will then read: "Radioactive materials."

(D) By amending § 174.541(b) to read as follows:

**§ 174.541 "Dangerous" placards; "Dangerous-Radioactive material" placards; or "Caution-Residual phosphorus" placards.**

(b) "Dangerous-Radioactive Material" placards, as prescribed in § 174.553, must be applied to cars containing packages bearing a "radioactive yellow-III" label (three vertical red stripes) as prescribed in § 173.414(d) of this chapter, and to carload lots under §§ 173.392 and 173.393 (j) and (k) of this chapter.

(E) By amending § 174.544(a) (6) to read as follows:

**§ 174.544 Placards not required.**

(6) Cars containing packages of radioactive material which are exempted from labeling under § 173.391 of this chapter; which bear only the labels prescribed in § 173.414 (b) and (c) of this chapter; or which are exempted from placarding under § 173.392(c) (7) of this chapter.

(F) By amending the introductory text of paragraph (a) of § 174.553 to read as follows:

**§ 174.553 Dangerous-Radioactive Material placard.**

(a) The "Dangerous-Radioactive Material" placard for radioactive materials must be of diamond shape, measuring 10¾ inches on each side, and must bear the wording in red letters as shown in the following cut:

(G) By amending paragraph (d) and adding paragraph (e) in § 174.566 to read as follows:

**§ 174.566 Cleaning cars.**

(d) Cars contaminated with radioactive materials:

(1) Each car used for transporting low specific activity radioactive materials in carload lots under the provisions of § 173.392(d) of this chapter must be surveyed with appropriate radiation detection instruments after each use. Carriers must not return such cars to service until the radiation dose rate at any accessible surface is not more than 0.5 millirem per hour, and there is no significant removable radioactive surface contamination (see § 173.399 of this chapter).

(2) This paragraph does not apply to any car used solely for transporting radioactive materials if a survey of the interior surface shows that the radiation dose rate does not exceed 10 millirem per hour at the interior surface or 2 millirem per hour at 3 feet from any interior surface. These cars must be stenciled with the words "For Radioactive Materials Use Only" in lettering at least three inches high in a conspicuous place on both sides of the exterior of the car. These cars must be kept closed at all times other than loading and unloading.

(e) In case of fire, wreck, breakage or unusual delay involving shipments of radioactive material, see § 174.588.

**§ 174.584 [Amended]**

(H) By amending the table in paragraph (a) of § 174.584 as follows and canceling footnote 1 to the table:



Label notation to follow entry of the article on the billing	Placard notation to follow entry of the article on the billing	Placard endorsement must be 3/4" high and appear on the billing near the space provided for the car number
<b>Add</b>		
For radioactive materials with "radioactive white-I" or "radioactive yellow-II" labels.	Radioactive white-I or radioactive yellow-II.	None.
For radioactive materials with "radioactive yellow-III" label.	Radioactive yellow-III.	Dangerous-radioactive material placard.
<b>Cancel</b>		
For radioactive materials. Class D poison.	Radioactive material label.	Do.

<sup>1</sup> Canceled.

(I) By amending the heading and paragraph (h) in § 174.586 to read as follows:

**§ 174.586 Handling hazardous materials.**

(h) Radioactive materials:

(1) The number of packages of radioactive materials, as provided in §§ 173.393 through 173.396 of this chapter, in any rail car or storage location, must be limited so that the total transport index number, as defined in § 173.389(i) of this chapter and determined by adding together the transport index numbers on the labels of the individual packages, does not exceed 50. This provision does not apply to sole-use shipments described in § 173.393 (j) or (k) or § 173.392 of this chapter.

(2) Packages of radioactive material bearing "radioactive yellow-II" or "radioactive yellow-III" labels must not be placed in cars, depots, or other places closer than 3 feet to an area (or dividing partition between areas) which may be continuously occupied by passengers, employees, or shipments of animals, nor closer than 15 feet to any package containing undeveloped film (if so marked). If more than one of these packages is present, the distance must be computed from the table below on the basis of the total transport index number (determined by adding together the transport index numbers on the labels of the individual packages) of packages in the car or storeroom:

Total transport index	Minimum separation distance in feet to nearest undeveloped film	Minimum distance in feet to area of persons, or minimum distance in feet from dividing partition of a combination car
None	0	0
0.1-10.0	15	3
10.1-20.0	22	4
20.1-30.0	29	5
30.1-40.0	33	6
40.1-50.0	36	7

NOTE 1: The distance in the table must be measured from the nearest point on the packages of radioactive materials.

(J) By amending § 174.588(c) (1) to read as follows:

**§ 174.588 Disposition of damaged or astray shipments.**

(c) \* \* \*

(1) Radioactive materials: In case of fire, accident, breakage, or unusual delay involving shipments of radioactive materials, the carrier shall immediately notify the shipper and the Department. Cars, buildings, areas, or equipment in which radioactive materials have been spilled may not be again placed in service or routinely occupied until the radiation dose rate at any accessible surface is less than 0.5 millirem per hour and there is no significant removable radioactive surface contamination (see § 173.399 of this chapter).

NOTE 1: In these instances, the package or materials should be segregated as far as practicable from personnel contact. If radiological advice or assistance is needed, the U.S. Atomic Energy Commission should also be notified. In case of obvious leakage, or if it appears likely that the inside container may have been damaged, care should be taken to avoid inhalation, ingestion, or contact with the radioactive material. Any loose radioactive materials should be left in a segregated area and held pending disposal instructions from qualified persons.

NOTE 2: Details involving the handling of radioactive materials in the event of an accident can be found in Bureau of Explosives Pamphlet No. 22, "Recommended Practices for Handling Collisions and Derailments Involving Explosives, Gasoline and Other Dangerous Articles," available from the Bureau of Explosives, Association of American Railroads, 2 Pennsylvania Plaza, New York, N.Y. 10001.

(K) By amending paragraph (n) of § 174.589 to read as follows:

**§ 174.589 Handling cars.**

(n) Position in train of cars containing radioactive materials. In a freight train or mixed train, either standing or during transportation thereof, a car placarded "Dangerous—Radioactive Material" must not be handled next to cars placarded "Explosives" or next to carload shipments of undeveloped film.

**PART 175—CARRIERS BY RAIL EXPRESS**

V. Part 175 is amended as follows:

(A) By amending paragraph (b) of § 175.652a to read as follows:

**§ 175.652a Shipping papers.**

(b) Where the regulations (except § 173.402(c) of this chapter) exempt the packages from labeling the exemption must be indicated by the words "No Label Required" immediately following the description on the shipping paper.

(B) By amending paragraph (j) of § 175.655 to read as follows:

**§ 175.655 Protection of packages.**

(j) Radioactive materials:

(1) The number of packages of radioactive materials, as provided in §§ 173.393 through 173.396 of this chapter, in any rail car or storage location, must be limited so that the total transport index number, as defined in § 173.389(h) of this chapter and determined by adding together the transport index numbers shown on the labels of the individual packages, does not exceed 50. This provision does not apply to sole-use shipments described in § 173.393 (j) or (k) or § 173.397 of this chapter.

(2) Packages of radioactive material bearing "radioactive yellow II" or "radioactive yellow III" labels shall not be placed in cars, depots, or other places closer than 3 feet to an area (or dividing partition between areas) which may be continuously occupied by passengers, employees, or shipments of animals, nor closer than 15 feet to any package containing undeveloped film (if so marked). If more than one of these packages is present, the distance shall be computed from the following table on the basis of the total transport index number (determined by adding together the transport index numbers on the labels of the individual packages) of packages in the car or storeroom.

Total transport index	Minimum separation distance in feet to nearest undeveloped film	Minimum distance in feet to area of persons, or minimum distance in feet from dividing partition of a combination car
None	0	0
0.1-10.0	15	3
10.1-20.0	22	4
20.1-30.0	29	5
30.1-40.0	33	6
40.1-50.0	36	7

NOTE 1: The distance in the table must be measured from the nearest point on the packages of radioactive materials.

(3) In case of fire, accident, breakage, or unusual delay involving shipments of radioactive materials, the carrier shall



immediately notify the shipper and the Department. Cars, buildings, areas, or equipment in which radioactive materials have been spilled may not be again placed in service or routinely occupied until the radiation dose rate at any accessible surface is less than 0.5 millirem per hour and there is no significant removable radioactive surface contamination (see § 173.399 of this chapter).

NOTE 1: In these instances, the package or materials should be segregated as far as practicable from personnel contact. If radiological advice or assistance is needed, the U.S. Atomic Energy Commission should also be notified. In case of obvious leakage, or if it appears likely that the inside container may have been damaged, care should be taken to avoid inhalation, ingestion, or contact with the radioactive material. Any loose radioactive materials should be left in a segregated area and held pending disposal instructions from qualified persons.

NOTE 2: Details involving the handling of radioactive materials in the event of an accident can be found in Bureau of Explosives Pamphlet No. 22, "Recommended Practices for Handling Collisions and Derailments Involving Explosives, Gasoline and Other Dangerous Articles," available from the Bureau of Explosives, Association of American Railroads, 2 Pennsylvania Plaza, New York, N.Y. 10001.

## PART 177—SHIPMENTS MADE BY WAY OF COMMON, CONTRACT, OR PRIVATE CARRIERS BY PUBLIC HIGHWAY

VI. Part 177 is amended as follows:

(A) By adding the following new sections to the table of contents:

Sec.  
177.842 Radioactive material.  
177.843 Contamination of vehicles.  
177.861 Accidents; radioactive materials.

(B) By amending paragraph (b) and introductory text of paragraph (c) in § 177.815 to read as follows:

### § 177.815 Labels.

(b) Labels are not required on truckload lots of dangerous articles, except for the commodities listed in this paragraph, when the shipments are loaded by the shipper, and are unloaded by the consignee from the transport vehicle in which originally loaded. The commodities for which this exemption does not apply include: Poisons, Class A, etiologic agents; and radioactive materials.

(1) Labels are not required on truckload lots of shipments of classes A or C poisons, etiologic agents, or radioactive materials made by, for, or to the Department of Defense if the shipments are loaded by the shipper and unloaded by the consignee from the transport vehicle in which originally loaded and if the shipments are accompanied by qualified personnel supplied with equipment to repair leaks or other container failures which would permit escape of contents.

(2) The proper shipping name of the contents must be marked on each pack-

age shipped under the exemption in this paragraph.

(c) Except on packages of classes A or C poisons, etiologic agents, or radioactive materials, labels are not required on less-than-truckload shipments by motor vehicle by public highway when the articles are readily identifiable by reason of type of container or when the container is plainly marked to indicate its contents; and

(C) By amending paragraph (b) of § 177.817 to read as follows:

### § 177.817 Shipping papers.

(b) Where the regulations (except § 173.402) exempt the packages from labeling the exemption must be indicated by the words "No Label Required" immediately following the description on the shipping paper.

### § 177.823 [Amended]

(D) By amending the ninth listing in § 177.823(a) (1) to read as follows:

Commodity	Type of marking or placard
Change: Radioactive material requiring "radioactive yellow-III" label, any quantity (see § 173.414 (d)).	RADIOACTIVE (black letters on yellow background).

### § 177.841 [Amended]

(E) By canceling § 177.841(d).

(F) By adding new §§ 177.842 and 177.843 as follows:

### § 177.842 Radioactive material.

(a) The number of packages of radioactive materials, as provided for in §§ 173.393 through 173.396 of this chapter, in any motor vehicle, trailer or storage location must be limited so that the total transport index number, as defined in § 173.389(h) of this chapter, and determined by adding together the transport index numbers shown on the labels of the individual packages does not exceed 50. This provision does not apply to sole-use shipments described in §§ 173.393 (j) or (k) or § 173.397 of this chapter.

(b) Packages of radioactive material bearing "radioactive yellow II" or "radioactive yellow-III" labels shall not be placed in motor vehicles or other places closer than the distances shown in the following table to any area which may be continuously occupied by passengers, employees, or shipments of animals, nor closer than the distances shown in the table below to any package containing undeveloped film (if so marked). If more than one of these packages is present, the distance shall be computed from the following table on the basis of the total transport index number (determined by adding together the transport index numbers on the labels of the individual packages) of packages in the vehicle or storeroom.

Total transport index	Minimum separation distances in feet to nearest undeveloped film for various times of transit					Minimum distance in feet to area of persons, or minimum distance in feet from dividing partition of cargo compartments
	Up to 2 hours	2-4 hours	4-8 hours	8-12 hours	Over 12 hours	
None.....	0	0	0	0	0	0
0.1 to 1.0.....	1	2	3	4	5	1
1.1 to 5.0.....	3	4	6	8	11	2
5.1 to 10.0.....	4	6	9	11	15	3
10.1 to 20.0.....	5	8	12	16	22	4
20.1 to 30.0.....	7	10	15	20	29	5
30.1 to 40.0.....	8	11	17	22	33	7
40.1 to 50.0.....	9	12	19	24	36	6

NOTE 1: The distance in the table must be measured from the nearest point on the packages of radioactive materials.

(c) Shipments of low specific activity materials, as defined in § 173.391 of this chapter, must be loaded so as to avoid spillage and scattering of loose materials. Loading restrictions are set forth in § 173.397 of this chapter.

(d) Packages must be so blocked and braced that they cannot change position during conditions normally incident to transportation.

(e) Persons should not remain unnecessarily in a vehicle containing radioactive materials.

### § 177.843 Contamination of vehicles.

(a) Each motor vehicle used for transporting low specific activity radioactive materials in truckload lots under the

provisions of § 173.392(d) of this chapter must be surveyed with appropriate radiation detection instruments after each use. Carriers must not return such vehicles to service until the radiation dose rate at any accessible surface is not more than 0.5 millirem per hour, and there is no significant removable radioactive surface contamination (see § 173.399 of this chapter).

(b) This section does not apply to any vehicle used solely for transporting radioactive material if a survey of the interior surface shows that the radiation dose rate does not exceed 10 millirem per hour at the interior surface or 2 millirem per hour at 3 feet from any interior surface. These vehicles must be stenciled with the words "For Radioactive Materials Use Only" in lettering at least 3 inches high in a conspicuous place, on



both sides of the exterior of the vehicle. These vehicles must be kept closed at all times other than loading and unloading.

(c) In case of fire, accident, breakage, or unusual delay involving shipments of radioactive material, see § 177.861.

**§ 177.848 [Amended]**

(G) By deleting the phrase "Class D poisons" from item 15 in vertical and horizontal columns in § 177.848(a) Chart. Item 15 will then read: "Radioactive materials."

**§ 177.860 [Amended]**

(H) By canceling paragraphs (c) and (d) in § 177.860.

(I) By adding § 177.861 to read as follows:

**§ 177.861 Accidents; radioactive materials.**

(a) *Radioactive materials.* In case of fire, accident, breakage, or unusual delay involving shipments of radioactive materials, the carrier shall immediately notify the shipper and the Department. Vehicles, buildings, areas, or equipment in which radioactive materials have been spilled may not be again placed in service or routinely occupied until the radiation dose rate at any accessible surface is less than 0.5 millirem per hour and there is no significant removable radioactive surface contamination (see § 173.399 of this chapter).

NOTE 1: In these instances, the package or materials should be segregated as far as practicable from personnel contact. If radiological advice or assistance is needed, the U.S. Atomic Energy Commission should also be notified. In case of obvious leakage, or if it appears likely that the inside container may have been damaged, care should be taken to avoid inhalation, ingestion, or contact with the radioactive material. Any loose radioactive material should be left in a segregated area and held pending disposal instructions from qualified persons.

NOTE 2: Details involving the handling of radioactive materials in the event of an accident can be found in Bureau of Explosives Pamphlet No. 22, "Recommended Practices for Handling Collisions and Derailments Involving Explosives, Gasoline and Other Dangerous Articles," available from the Bureau of Explosives, Association of American Railroads, 2 Pennsylvania Plaza, New York, N.Y. 10001.

(b) *Cleaning vehicles.* See § 177.843.

(J) By amending § 177.870(g) to read as follows:

**§ 177.870 Regulations for passenger-carrying vehicles.**

(g) *Radioactive materials.* In addition to the limitations prescribed in paragraphs (b) and (e) of this section, no person may transport any radioactive material requiring labels under § 173.402 of this chapter in or on any motor vehicle carrying passengers for hire except where no other practicable means of transportation is available. Packages of radioactive materials must be stored only in the trunk or baggage compartment of the vehicle, and must not be stored in any compartment occupied by persons. Packages of radioactive materials must be handled and placed in the vehicle as prescribed in § 177.841(d).

**PART 178—SHIPPING CONTAINER SPECIFICATIONS**

VII. Part 178 is amended as follows:

(A) By amending the title of § 178.103, and by adding §§ 178.104 and 178.350, and Subpart K to the table of contents to read as follows:

Sec.  
178.103 Specification 6L; metal packaging.  
178.104 Specification 6M; metal packaging.

Subpart K—Specifications for General Packagings

178.350 Specification 7A; general packaging, Type A.

(B) By amending § 178.34-5 to read as follows:

**§ 178.34-5 Marking.**

(a) Each container shall be marked with the words "Radioactive Material," in letters at least one-fourth inch in height, either by embossing or diestamping directly onto the container, or by securely affixing by welding or brazing a metal plate bearing this notation to the container.

§§ 178.38-13, 178.39-13, 178.40-13, 178.41-13, 178.42-10, 178.43-13, 178.44-13, 178.48-13, 178.49-13, 178.50-13, 178.51-13, 178.52-13, 178.53-12, 178.54-13, 178.55-13, 178.56-13, 178.59-11, 178.60-13, 178.63-12, 178.66-12, 178.67-12, 178.68-12 [Amended]

(C) In the following sections, change the reference "§ 173.34(f)" to read "§ 173.34(d)" and change the reference to "§ 173.301(i)" to read "§ 173.301(g)":  
§§ 178.38-13, 178.39-13, 178.40-13, 178.41-13, 178.42-10, 178.43-13, 178.44-13, 178.48-13, 178.49-13, 178.50-13, 178.51-13, 178.52-13, 178.53-12, 178.54-13, 178.55-13, 178.56-13, 178.59-11, 178.60-13, 178.63-12, 178.66-12, 178.67-12, and 178.68-12.

**§§ 178.47-13, 178.58-13 [Amended]**

(D) In §§ 178.47-13 and 178.58-13, change the reference to "§ 178.34(f)" to read "§ 178.34(d)".

**§ 178.57-13 [Amended]**

(E) In § 178.57-13, change the reference to "§ 178.34(f)" to read "§ 173.34(d)", and change the reference to "§ 173.304(f)" to read "§ 173.304(b)(2)".

(F) By amending the title of § 178.103, and by amending § 178.103-2(a) to read as follows:

§ 178.103 Specification 6L; metal packaging.

**§ 178.103-2 Rated capacity.**

(a) Rated capacity as marked (see § 178.103-6). Not less than 55 gallons nor more than 110 gallons for the outer steel drum. Not more than 17.74 liters for the inner vessel.

(G) By amending § 178.103-3 in its entirety to read as follows:

**§ 178.103-3 General requirements.**

(a) Outside drum must conform to specification 6J (§ 178.100) steel drum, or equivalent, except as otherwise specified herein. The drum wall must be at least 18-gauge steel, and may be either a single sheet of steel, or may be produced

by welding together two appropriate lengths of such drums. The removable head must be constructed of at least 16-gauge steel with one or more corrugations in the cover near the periphery.

(b) Inner vessel must conform to specification 2R (§ 178.340) or equivalent (except that cast iron is not authorized), with maximum usable inside diameter of 5¼ inches, maximum height of 50 inches (with cap in place) and minimum wall thickness of one-fourth inch. Flanged closures are not authorized. Pipe threads must be luted with appropriate nonhardening compound to prevent leakage of water or loosening of the cap due to vibration or heat.

(c) Inner vessel must be fixed within the outer drum with appropriate centering devices of adequate physical strength and fire resistance to be able to withstand the accident test conditions of § 173.398 of this chapter without a displacement of the inner container of more than 2 inches in any direction. The following types of centering mechanisms meet this requirement without need for performing the accident tests. Any other type of centering device must be specifically approved by the Department.

(1) Not less than four steel rod spacers, of at least one-fourth inch (for packages of 55-gallon capacity) or three-eighths inch (for packages with greater than 55-gallon capacity) cold rolled steel, welded to the pipe at each end by minimum 2-inch continuous weld. Rods must be welded to the pipe at radial positions not exceeding 90°, and so as not to interfere with closure of inner vessel. Each spacer rod must extend at least 2¼ inches beyond the inner vessel at each end, then radially to the wall of the outer drum (to provide a springlike snug fit) and along the entire length of the wall of the outer drum. For packages of more than 55-gallon capacity, each spacer rod shall be braced by welding a ¼-inch by 2-inch steel plate to the spacer rod and the pipe with a continuous weld at each joint, the joints being located approximately halfway along the length of the drum.

(2) At least three steel "spiders," not more than 24 inches apart, with each spider having at least four legs. Each leg must be constructed of materials having dimensions not less than those listed in this subparagraph, welded by continuous weld at each joint to inner and outer steel bands of at least ¼-inch by 1-inch steel. The inner steel band must be welded to the inner vessel by at least six 2-inch welds on both edges of the band. The outer steel band must be welded to the outer drum by at least six 2-inch welds on both edges of the top outer band, such that the inner vessel is at least 2¼ inches from the top and bottom of the drum. Authorized construction materials are:

(i) ¼-inch by ¼-inch by 1-inch steel angle iron.

(ii) ¾-inch by ¾-inch by 1¼-inch steel angle iron.

(iii) ¼-inch thick, 1-inch outer diameter schedule 40 steel pipe.

(iv) 1½-inch diameter solid steel rods, with only two such spiders required instead of three.



(d) The void between the inner vessel and the outer drum shall be filled with either vermiculite (expanded mica) with a density of at least 4.5 pounds per cubic foot or other material having an equivalent thermal and shock absorbing effect.

(H) By amending § 178.103-5 in its entirety to read as follows:

**§ 178.103-5 Closure.**

(a) The outer drum closure shall be at least a 12-gauge bolted ring with drop-forged lugs, one of which is threaded, and having at least a steel bolt (at least  $\frac{3}{8}$ -inch for 55-gallon size, and at least  $\frac{5}{8}$ -inch for larger than 55-gallon size) and a lock nut, or equivalent device.

(b) The closure device must have a means for the attachment of a tamper-proof lock wire and seal, or equivalent.

(I) By adding subparagraph (4) to § 178.103-6(a) to read as follows:

**§ 178.103-6 Markings.**

(a) \* \* \*

(4) Gauge of metal of the outer steel drum in the thinnest part, rated capacity of the outer steel drum in gallons, and the year of manufacture of the assembled package (e.g., 18-110-68). When the gauge of the metal in the drum wall differs from that in the head, both must be indicated with a slanting line between, and with the gauge of the body indicated first (e.g., 18/16-110-68 for 18-gauge body and 16-gauge head).

(J) By adding the following new § 178.104:

**§ 178.104 Specification 6M; metal packaging.**

**§ 178.104-1 General requirements.**

(a) Each package must meet the applicable requirements of § 173.24 of this chapter.

**§ 178.104-2 Rated capacity.**

(a) Rated capacity as marked (see § 178.104-5). Not less than 10 gallons nor more than 110 gallons for the outer steel drum. Not less than 1.24 liters for the inner containment vessel.

**§ 178.104-3 General construction requirements.**

(a) Outside drum must conform to specification 6C or 17C (§§ 178.99 and 178.115) steel drum, or equivalent, except as otherwise specified herein. The drum wall may be either a single sheet of steel, or may be produced by welding together two appropriate lengths of such drums. Removable head for drums of 55 gallons or larger size must have one or more corrugations in the cover near the periphery. Maximum gross weight, metal thickness, and minimum end insulation for the marked capacity is as follows:

Marked capacity (gallons)	Authorized gross weight (pounds)	Minimum thickness of uncoated sheets and heads (gauge)	Minimum thickness of end insulation (inches)
10	160	20	$1\frac{1}{8}$
15	160	20	$1\frac{1}{8}$
30	450	18	$3\frac{1}{4}$
55	880	16	$3\frac{1}{4}$
110	880	16	$3\frac{1}{4}$

(b) Inner containment vessel must conform to specification 2R (§ 178.34), or equivalent, with maximum usable inside diameter of 5.25 inches, minimum usable inside diameter of 4 inches, and minimum height of 6 inches. Material of construction must be steel with a minimum wall thickness of 0.125 inch for vessels up to 12 inches in height and 0.250 inch for vessels over 12 inches in height. Pipe threads must be luted with an appropriate nonhardening compound to prevent leakage of water or loosening of the cap due to vibration or heat.

(c) Inner containment vessel must be fixed within the outer drum with appropriate centering devices of adequate physical strength and fire resistance to be able to withstand the accident test conditions prescribed in § 173.398 of this chapter without a displacement of the inner vessel of more than 2 inches in any direction. The following types of centering mechanisms meet this requirement without need for performing the accident tests. Any other type of centering device must be specifically approved by the Department.

(1) Machined discs and rings made of either solid industrial cane fiberboard insulation having a density of at least 15 pounds per cubic foot; or of hardwood or plywood, at least  $\frac{1}{2}$ -inch thick, having a density of at least 28 pounds per cubic foot; or of other material having an equivalent thermal, neutron, and shock absorbing effect. The sides of the inner vessel shall be protected by at least 3.75 inches of such material, and the ends by at least the thickness of such material prescribed in § 173.104-3(a) of this chapter. There must be no gap or direct heat path to the inner containment vessel.

(d) Any radiation shielding material used must be placed within the inner containment vessel, or must be protected in all directions by at least the thickness of the thermal insulating material prescribed in paragraph (a) of this section.

**§ 178.104-4 Closure.**

(a) The outer drum closure must be at least 16-gauge bolt-type locking ring having at least a  $\frac{5}{16}$ -inch steel bolt for drum sizes not over 15 gallons, or a 12-gauge bolted ring with drop-forged lugs, one of which is threaded, and a  $\frac{5}{8}$ -inch steel bolt for drum sizes over 15 gallons. Each bolt must be provided with a lock nut or equivalent device.

(b) The closure device must have means for the attachment of a tamper-proof lock wire and seal, or equivalent.

**§ 178.104-5 Markings.**

(a) Marking must be as prescribed in § 173.24 of this chapter.

(b) Marking on the outside of each package must be as follows: "DOT-6M Type B," "Radioactive Materials," or "Fissile Radioactive Materials," as appropriate; and the gauge of metal of the outer drum in the thinnest part, rated capacity of the outer drum in gallons, and year of manufacture (for example, 18-30-69). When the gauge of the metal in the drum wall differs from that in the head, both must be indicated with a slanting line between, and with the gauge of the body indicated first (e.g., 18/16-

55-69 for 18-gauge body and 16-gauge head).

**§ 178.205-38 [Canceled]**

(J) By canceling § 178.205-38.

(K) By adding a new Subpart K to read as follows:

**Subpart K—Specifications for General Packagings**

(L) By adding a new § 178.350 to read as follows:

**§ 178.350 Specification 7A; general packaging, Type A.**

**§ 178.350-1 General requirements.**

(a) Each packaging must meet all applicable requirements of § 173.24 of this chapter.

**§ 178.350-2 Specific requirements.**

(a) Each packaging must be so designed and constructed that it meets the standards for Type A packaging (see §§ 173.389(j) and 173.398(b) of this chapter).

**§ 178.350-3 Marking.**

(a) Marking on the outside of each packaging as follows: "USA DOT 7A Type A" and "Radioactive Material."

(b) Marking to conform with § 173.24 of this chapter.

2. In Title 14, Code of Federal Regulations, Part 103 is amended as follows:

(A) By amending § 103.1 (b) and (c) (3) to read as follows and by canceling paragraph (c) (4):

**§ 103.1 Applicability.**

\* \* \* \* \*

(b) For the purposes of this part, dangerous article means the material defined and regulated in the applicable regulations of the Department of Transportation (49 CFR Parts 170-190), and includes:

- (1) Explosives.
- (2) Flammable liquids, and solids.
- (3) Oxidizing materials.
- (4) Corrosive liquids.
- (5) Compressed gases.
- (6) Poisons.
- (7) Etiologic agents.
- (8) Radioactive materials.

(c) \* \* \*

(3) Shipments of radioactive materials via cargo-only aircraft, made by or under the direction or supervision of the U.S. Atomic Energy Commission or the Department of Defense, which are escorted by personnel especially designated by or under the authority of that Commission or Department for the purposes of national security.

(4) [Canceled]

(B) By amending § 103.3(b) to read as follows:

**§ 103.3 Certification requirements.**

\* \* \* \* \*

(b) The shipper shall execute the required certificates in duplicate. One signed copy accompanies the shipment and the originating air carrier retains the other signed copy.

\* \* \* \* \*



(C) By amending § 103.7 to read as follows:

**§ 103.7 Passenger-carrying aircraft.**

No person may carry any dangerous article in a passenger-carrying aircraft except—

(a) Articles specified by 49 CFR Part 173 as exempted from the specification packaging, marking, and labeling requirements of 49 CFR Part 173, when those articles are shipped as required for the exemption; and

(b) The following articles when packaged, marked, and labeled as specifically provided in 49 CFR Parts 171 through 173 for shipment by rail express:

(1) Small arms ammunition and practice cartridge ammunition.

(2) Class C explosives, other than those permitted under subparagraph (1) of this paragraph, with a net weight of not more than 50 pounds in each outside container.

(3) Subject to § 103.19(a), nonflammable compressed gases, except anhydrous ammonia, boron trifluoride, chlorine, hydrogen bromide, hydrogen chloride, nitrosyl chloride, and sulfur dioxide.

(4) X-ray film or motion picture film, with a nitrocellulose base, either exposed or unexposed.

(5) Pyroxylin plastics containing nitrocellulose, in sheets, rolls, rods, or tubes.

(6) Subject to § 103.19(b), radioactive materials.

(D) By amending § 103.9 to read as follows:

**§ 103.9 Cargo-only aircraft.**

(a) No person may carry any dangerous article in a cargo-only aircraft, except those articles permitted on passenger-carrying aircraft under § 103.7, and except articles that—

(1) Are specified in 49 CFR 172.5 as acceptable for shipment by rail express;

(2) Do not exceed the maximum quantity for each outside container specified in 49 CFR 172.5 for rail express; and

(3) Are packaged, marked, and labeled as specified in 49 CFR Part 173 for shipment by rail express.

(b) For the purposes of this part, a cargo-only aircraft is any aircraft that is not a passenger-aircraft.

(E) By amending § 103.19(b) to read as follows:

**§ 103.19 Quantity limitations.**

(b) No person may carry aboard an aircraft a number of packages of radioactive materials that make the total transport index number (determined by adding together the transport index numbers shown on the labels of the individual packages) more than 50.

**§ 103.21 [Canceled]**

(F) By canceling § 103.21.

(G) By amending § 103.23 to read as follows:

**§ 103.23 Special requirements for radioactive materials.**

(a) No person may place packages of radioactive materials bearing "radioactive yellow-II" or "radioactive yellow-III" labels in aircraft closer than the distances shown in the following table to a space (or dividing partition between spaces) which may be continuously occupied by people, or shipments of animals, or closer than the distances shown in the following table to any package containing undeveloped film (if so marked). If more than one of these packages is present, the distance shall be computed from the following table on the basis of the total transport index numbers shown on the labels of the individual packages in the aircraft:

Total transport index	Minimum separation distances in feet to nearest undeveloped film for various times of transit					Minimum distance in feet to area of persons, or minimum distance in feet from dividing partition of cargo compartments
	Up to 2 hours	2-4 hours	4-8 hours	8-12 hours	Over 12 hours	
None	0	0	0	0	0	0
0.1 to 1.0	1	2	3	4	5	1
1.1 to 5.0	3	4	6	8	11	2
5.1 to 10.0	4	6	9	11	15	3
10.1 to 20.0	5	8	12	16	22	4
20.1 to 30.0	7	10	15	20	29	5
30.1 to 40.0	8	11	17	22	33	6
40.1 to 50.0	9	12	19	24	36	7

(b) In case of fire, accident, breakage, or unusual delay involving shipments of radioactive materials, the operator of the aircraft shall immediately notify the shipper and the Department of Transportation. Aircraft in which radioactive materials have been spilled may not be again placed in service or routinely occupied until the radiation dose rate at any accessible surface is less than 0.5 millirem per hour and there is no significant removable radioactive surface contamination (see 49 CFR 173.399). In these instances, the package or materials should be segregated as far as practicable from personnel contact. If radiological advice or assistance is needed, the U.S. Atomic Energy Commission should also be notified. In case of obvious leakage, or if it appears likely that the inside container may have been damaged care

should be taken to avoid inhalation, ingestion, or contact with the radioactive materials. Any loose radioactive materials should be left in a segregated area pending disposal instructions from qualified persons.

(H) By amending paragraph (c) of § 103.31 to read as follows:

**§ 103.31 Cargo location.**

(c) No person may place a package of "yellow" label material (flammable solids or oxidizing materials) next to, or in a position to allow contact with, a package of "white" label material (poisons) in any aircraft.

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